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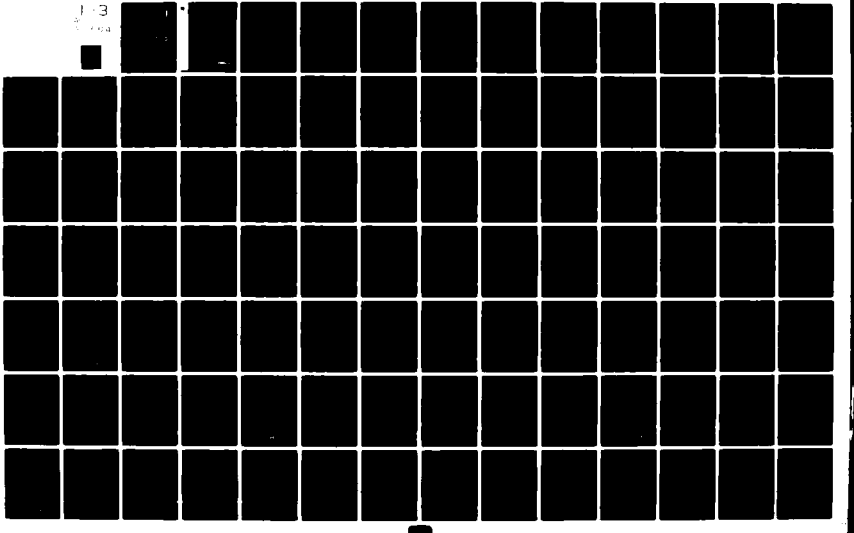

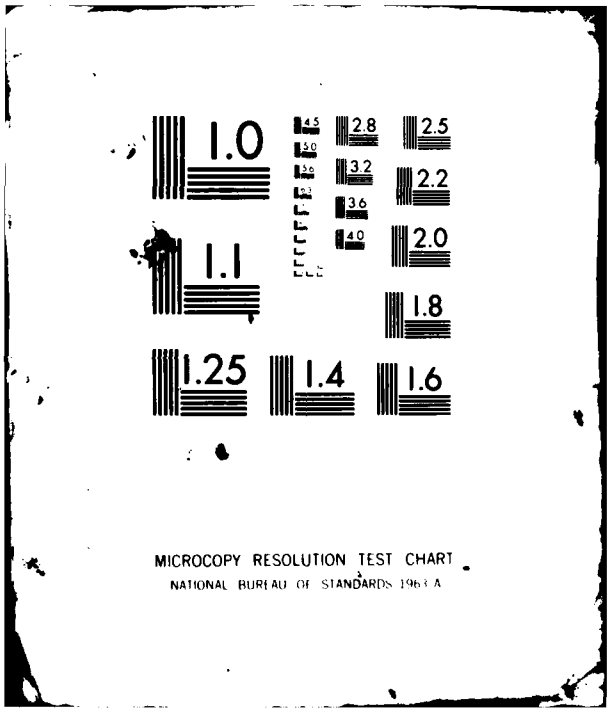
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GEOTECHNICAL EVALUATION

AD A113324

VOLUME II
NEVADA-UTAH
VERIFICATION STUDIES, FY 79
GEOTECHNICAL DATA, WHIRLWIND CDP, UTAH

PREPARED FOR

SPACE AND MISSILE SYSTEMS ORGANIZATION (SAMSO)

NORTON AIR FORCE BASE, CALIFORNIA

FUGRO NATIONAL, INC.

Consulting Engineers and Geologists

FN-TR-27-II

MX SITING INVESTIGATION
GEOTECHNICAL EVALUATION
VOLUME II, NEVADA-UTAH
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WHIRLWIND CDP, UTAH

Prepared for:

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*: THE OBJECTIVES OF THIS REPORT ARE TO VERIFY SUFFICIENT SUITABLE AREA FOR DEPLOYMENT OF THE MX SYSTEM AND TO PROVIDE PRELIMINARY PHYSICAL AND ENGINEERING CHARACTERISTICS OF THE SOILS.

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VOLUME II
GEOTECHNICAL DATA, WHIRLWIND CDP

TABLE OF CONTENTS

DRAWINGS IN POCKET

FOREWORD

This report was prepared for the Department of the Air Force, Space and Missile Systems Organization (SAMSO), in compliance with Contract No. F04704-78-C-0027, CDRL Item 005A2. It presents geological, geophysical, and geotechnical data and evaluates the suitability of portions of Nevada and Utah for siting the MX Land Mobile Advanced ICBM System.

This report is the first of several Verification reports which will be prepared. The objectives are to verify sufficient suitable area for deployment of the MX System and to provide preliminary physical and engineering characteristics of the soils. The Verification Studies are the final phase of a site-selection process which was begun in 1977. Previous studies have been termed Screening, Characterization, and Ranking. In preparing this report, it has been assumed that the reader is familiar with these previous studies.

Results of the FY 79 Verification studies are contained in 11 volumes as follows:

Geotechnical Results

Volume 1A - Sections 1.0, 2.0, and 3.0 contain Introduction, Results and Conclusions, and Recommendations for Future Studies. Sections 4.0 through 6.0 contain summary geotechnical data for Whirlwind, Snake East, and Hamlin CDP's.

Volume 1B - Sections 7.0 through 10.0 contain summary geotechnical data for White River North, Garden-Coal, Reveille-Railroad and Big Smoky CDP's.

Geotechnical Data Volumes

* Volume II - Whirlwind CDP
Volume III - Snake East CDP
Volume IV - Hamlin CDP
Volume V - White River North CDP
Volume VI - Garden-Coal CDP
Volume VII - Reveille-Railroad CDP
Volume VIII - Big Smoky CDP
Volume IX - Dry Lake CDP
Volume X - Ralston CDP

* This volume is presented herein.

SECTION 1.0

GEOLOGIC STATION DATA

EXPLANATIONS OF GEOLOGIC STATION DATA

Geologic stations were established at selected locations throughout the CDP at which detailed descriptions of surficial basin-fill deposits or rock were recorded. Locations of all geologic stations are shown in Drawing 1, Activity Location Map. All data taken on surficial basin-fill units at these stations are listed in Table 1-1 and an explanation of the column headings in the table is given below. At stations where rock descriptions were made, only geologic unit designations are listed. A general explanation of all geologic unit symbols used in Verification Studies is included at the end of this section.

Column Heading Table 1-1	Explanation
Station Number	Geologic stations are numbered sequentially. Where more than one geologic field team worked in a CDP, stations made by each team are differentiated with a letter (A, B, or C) following the station number.
Geologic Unit	Generic geologic unit only, i.e. the grain-size designation (f, s, g, c) is omitted from surficial basin-fill units. The letter B in the unit designation indicates a buried deposit not exposed at the surface.
MPS MM	Average maximum particle size in millimeters.
Grain Size (%B, %C, %G, %S, %F)	Estimated particle size distribution using the Unified Soil Classification System. Percentages of boulders (%B) and cobbles (%C) are based on the entire deposit, whereas percentages of gravel (%G), sand (%S) and fines (%F) are taken only on the fraction composed of particles less than 3 inches (76 mm) in diameter.
USCS	Soil class according to the Unified Soil Classification System.

Munsell Color — Soil color based on Munsell Soil Color Chart.

Source Rock Types(s) — Rock types of coarse clasts listed in order of abundance.

* Physical Properties — Data listed in columns 6 through 15 address specific soil properties. These are listed below in parentheses following the column heading number and are also listed at the bottom of Table 1-1. Data are coded with each numerical entry referring to a specific soil condition as listed below.

6	(Grain Shape)	1) Angular, 2) Subangular, 3) Subrounded, 4) Rounded, 5) Well rounded
7	(Moisture Content)	1) Dry, 2) Moist, 3) Wet
8	(Plasticity of Fines)	1) None, 2) Low, 3) Medium, 4) High
9	(Consistency)	Coarse grained: 1) Very Loose, 2) Loose, 3) Medium Dense, 4) Dense, 5) Very Dense, Fine grained: 1)Soft, 2) Firm, 3) Stiff, 4) Hard
10	(Structure)	1) Stratified Tabular, 2) Stratified Other (lensed, cross bedded, discontinuous beds), 3) Nonstratified
11	(Cementation Induration)	1) None, 2) Weak, 3) Moderate, 4) Strong
12	(Depth to Cemented Layers)	Depth to layer (in centimeters) exhibiting cementation induration described in Column 11 (above)
13	(Weathering of clasts)	1) Fresh, 2) Slight, 3) Moderate, 4) Very
14	(Soil Profile Development)	1) None (A-C profile), 2) Poor (incipient B-horizon), 3) Well (prominant B-horizon)
15	(Caliche Development)	1) Stage I, 2) Stage II, 3) Stage III, 4) Stage IV, 5) None

Drainage

DP (M)	Average depth of drainages (in meters)
WD (M)	Average width of drainages (in meters)
Slope (%)	Average slope of ground surface (in percent grade)
Sample	Number of samples taken

GENERALIZED GEOLOGIC UNITS

Explanation

Surficial Basin-fill Units

A1 Younger Fluvial Deposits - Major modern stream channel and flood-plain deposits.

A2 Older Fluvial Deposits - Older incised stream channel and flood-plain deposits in elevated terraces bordering major modern drainages.

A3 Eolian Deposits - Wind-blown deposits of sand occurring as either thin sheets (A3s) or dunes (A3d).

A4 Playa and Lacustrine Deposits - Deposits occurring in modern, active playas (A4) or in either inactive playas or older lake beds and abandoned shorelines associated with extinct lakes (A4o).

A5 Alluvial Fan Deposits - Alluvial deposits consisting of debris flow and water-laid alluvium near mountain fronts, grading into predominantly water-laid alluvium deposited in shifting distributary channels near the basin center. Younger (A5y), intermediate (A5i), and older (A5o) alluvial fans are differentiated by surface soil development, terrain conditions, and present depositional/erosional environment.

Grain sizes of these deposits (except A3 deposits, which are exclusively sandy) are indicated by a single letter (f, s, g, or c) following the geologic unit symbol. These letters indicate the predominant grain size and range of soil types according to the Unified Soil Classification System:

f - fine-grained (ML, CL, MH, CH)

s - sands (SP, SW, SM, SC)

g - gravels (GP, GW, GM, GC)

c - coarse grained with greater than 30 percent boulders and cobbles (generally GP, GW, GM, GC)

ROCK UNITS

I Igneous (undifferentiated). Rocks formed by solidification of a molten or partially molten mass.

- I1 Intrusive - Plutonic rocks formed by solidification of molten material beneath the surface (e.g., granite, granodiorite, diorite, gabbro).
- I2 Extrusive (intermediate and acidic) - Volcanic rocks of intermediate and acidic compositon formed by solidification of molten material at or near the surface, (e.g., rhyolite, latite, dacite, andesite,.
- I3 Extrusive (basic) - Volcanic rocks of basic composition, generally formed by solidification of molten materials at or near the surface (e.g., basalt).
- I4 Extrusive (pyroclistic) - Rocks formed by accumulation of volcanic ejecta (e.g., ash, tuff, welded tuff, agglomerate).

S Sedimentary (undifferentiated) - Rocks formed by accumulation of clastic solids, organic solids and/or chemically precipitated minerals.

- S1 Arenaceous and/or Siliceous Rocks - Composed of sand size particles (e.g., sandstone, orthoquartzite) or of cryptocrystalline silica (e.g., opal, chert).
- S2 Carbonate Rocks - Composed predominantly of calcium carbonate detritus or chemical precipitates (e.g., limestone, dolomite, chalk).
- S3 Argillaceous Rocks - Composed of clay and silt-sized particles (e.g., siltstone, shale, claystone).
- S4 Evaporite Rocks - Precipitated from solution as a result of evaporation (e.g., halite, gypsum, anhydrite, sylvite).
- S5 Coarse Clastic Rocks - Composed of gravel sized or larger clasts (e.g., conglomerate, breccia).

M Metamorphic (undifferentiated) - Rocks formed through recrystallization in the solid state of preexisting rocks by heat and pressure (e.g., gneiss, schist, hornfels, metaquartzite).

SOIL DESCRIPTION / TERRAIN

STATION NUMBER	GEOL UNIT	MPS MM	GRAIN SIZE %B	%C	%G	%S	%F	USCS	MUNSELL COLOR	SOURCE ROCK TYPE(S)	6	7	8	9	10	11	12	13	14	15	DRAINAGE DEPTH(FT)	WIDTH(FT)	SLOPE (%)	SAMPLE
NWG01A	A40	350	00	05	05	075	020	GC	10.0YR6/4	S2	2	2	3	4	3	2	013	3	2	2				
NWG01B	A40	060	00	05	80	020	030	GW	10.0YR4/3	S2 I2	1	1	1	2	3	2	015	2	1	1	6.0	030	03	1
NWG02A	A4Y	001	00	00	00	000	100	CL	02.5YR6/4			1	2	2	1	2			1	1				1
NWG02A	A40	040	00	00	25	065	010	SW-SM	10.0YR6/3	S2	5	2	1	2	2	1		1	2	2	5.0	060		1
NWG02B	A50	030	00	01	05	075	020	SM	07.5YR5/4	S2	2	1	2	4	3	3	020	2	1	3				1
NWG03A	A51	040	00	00	05	080	015	SM	10.0YR6/4	S2 I2	5	2	1	3	3	2	024	2	1	2				1
NWG03B	A5Y	100	00	05	10	075	015	SM	07.5YR5/4	S2	2	1	2	3	2	1		2	2	1			[illegible]	1
NWG04A	A40	050	00	00	60	340	000	GP-GW	10.0YR5/4	S2	3	2		2	2	1		2	1	1				1
NWG04B	A51	010	00	00	07	055	045	SC-ML	07.5YR5/4	S2		2	3	3	1	3	030		2	2				1
NWG05A	A51	060						SP	07.5YR5/4	S2	2	2		2	2	1		2	2	1				1
NWG05B	A40	055	02	00	02	048	050	ML-SC	05.0YR4/4	I3 S2		1	3	4	3	4	021	4	2	3				1
NWG06A	A5Y	050	00	00	05	085	010	SM-SP	10.0YR4/4	S2	3	1	2	3	3	1		3	1	2	.0	000	11	1
NWG06B	A51	030	00	01	05	075	020	SM	07.5YR5/4	S2 S1	2	1	2	3	3	3	015	3	2	2			2	6
NWG07A	A40	070	00	05	20	080	000	SP-SW	10.0YR5/3	I2 I4	2	1		2	2	1		2	2	1				1
NWG07B	A51	080	05	10	10	080	010	SW-SP	05.0YR8/6	I2		1	2	4	3	4	015	3	3	4	2.0	012	01	1
NWG07C	I40	020	00	00	01	099	000	SW-SP	10.0YR3/2	I4	2	2	1	3	1	1		2						1
NWG08A	A51	100	00	05	20	075	005	SW-SM	10.0YR6/4	S2	5	1	2	3	3	2	020	2	3	2	1.0	015	02	2
NWG09B	I3																							
NWG09A	A51	030	00	00	40	055	005	SP-SW	07.5YR6/4	S2	2	1	2	3	3	3	027	2	2	3	1.0	005	04	2
NWG09B	A50	075	00	01	05	085	010	SW-SM	07.5YR6/4	I3	2	1	1	4	3	4	030	2	1	4			02	1
NWG10A	A51	120	00	02	45	050	005	SW-SP	10.0YR6/4	S2	2	1	2	3	3	2	020	2	2	2	1.0	003	04	0
NWG10B	A50	039	00	01	05	080	015	SC-SM	07.5YR6/6	I3 S2	2	2	3	4	3	3	031	2	2	3			02	1
NWG11A	A51	135	00	05	25	065	010	SW-SM	07.5YR5/6	S2	2	1	2	2	2	2	024	2	2	3	2.0	010	03	6
NWG11B	A40	005	00	01	35	063	002	GW	07.5YR5/4	S2 I2	2	1	1	2	2	3	024	2	2	2			1	1
NWG12A	A51	110	00	05	40	050	010	SW-SM	10.0YR6/3	S2	4	1	2	2	2	2	015	2	2	1	.0	000	02	2
NWG12B	S2																							
NWG13A	A51	050	00	00	20	075	005	SP-SW	07.5YR5/6	S2	2	1	2	3	2	2	024	2	2	2	1.0	005	02	2
NWG13B	A50	003	00	00	05	080	015	SM	07.5YR4/4	S2	2	1	2	4	3	3	030	2	2	3			02	1
NWG14A	A40	075	00	00	70	028	002	GP	07.5YR8/2	S2 I4	2	1	1	2	4	1		1	1	1				2
NWG14B	I3																							
NWG15A	A5Y	040	00	00	07	088	005	SP-SM	10.0YR4/6	I2	2	1	1	3	3	2	024	3	2	2				1
NWG15B	A5Y	050	00	01	32	088	010	SP-SP	07.5YR6/6	I2	2	1	2	3	3	3	007	2	2	2			02	1
NWG16A	A40	030	00	03	35	085	010	SP-SM	10.0YR5/4	S2	3	1	2	3	3	3	023	2	2	1	1.0		01	1
NWG16B	A5Y	010	00	00	02	096	002	SW	10.0YR6/3		2	2	1	4	2	1	014		1	1			02	1
NWG17A	S5	140	00	04	40	045	015	SW	10.0YR5/4	S2 I1	4	1	5	4	3	3	021	2	2	1			02	1
NWG17B	A50	007	00	01	05	085	010	SM-SP	07.5YR5/6	S2	2	1	2	4	2	4	021	2	2	4	3.0	015	02	1
NWG18A	S5																						02	1
NWG18A	S5																						2	1
NWG18B	A51	040	00	07	15	078	015	SC	07.5YR5/4	S2	2	1	3	4	3	3	024	2	2	2	1.5	005	04	1
NWG19A	S5																						02	1
NWG19A	S5																						02	1
NWG19B	A51	050	00	01	20	070	010	SP-SP	07.5YR5/6	S2	2	1	2	4	2	3	026	2	2	3	.2	005	02	2
NWG20A	A4	000	00	00	00	002	098	ML	10.0YR5/4			1	2	3	3	1			2	2			2	1
NWG20B	A40	006	00	00	30	040	020	SM	10.0YR6/3		2	1	3	4	2	3			2	2				
NWG20C	A51	015	00	04	60	040	007	GW		S1 I2	3	1	1	4	3	3	014	3	2	2	2.0	010	02	1
NWG21A	A40																						27	0
NWG21A	A40																				6.0		02	0
NWG21B	A51	150	05	05	10	080	010	SM-SP	07.5YR4/6	S1 I2	2	1	2	2	2	2	030	2	2		2.0	032	02	1
NWG22A	A5Y	050	00	02	07	088	005	SP-SM	10.0YR7/4	S2	2	1	1	2	3	2	030	2	1	1	1.5	015	02	1
NWG22B	A40	019	01	10	60	040	00T	GW		I2	3	1	1	4	1	2		3						1
NWG22C	A51	250	0T	03	55	045	00T	GW	10.0YR3/2	I2	2	1	1	3	3	3	017	2	2	1	4.0	150	02	1
NWG23A	A5Y	050	00	0T	15	075	010	SP-SM	07.5YR7/4	S2 I2	2	1	2	2	3	3	035	3	2	1	2.5	015	04	1
NWG23B	I4																							
NWG24A	A51	050	00	00	30	060	010	SW-SM	10.0YR6/3	S2	2	1	2	2	3	3	021	3	2	3	.4	020	14	1
NWG24B	A5Y	005	00	0T	50	035	015	GW	07.5YR6/4	S2	2	1	3	3	3	2	015	2	1	4			01	1
NWG25A	A51	120	00	02	35	055	010	SW-SM	10.0YR7/3	S2	2	1	2	2	3	1		2	1	1	1.0	007	04	1
NWG25B	A1		00	00	00	005	095	ML	10.0YR5/4			1	2	2	3	1			1	4			01	1
NWG26A	A51	165	00	02	25	070	005	SW-SM	07.5YR5/4	S2 I1	2	1	1	3	2	3	044	2	2	2	2.0	005	04	1
NWG26B	A5Y	050	00	0T	10	080	010	SM-SP	10.0YR5/4	S2	2	1	2	2	2	2	029	2	1	1	1.0	003	02	1
NWG27A	A51	095	00	02	50	045	005	GW-GM	10.0YR6/6	S2 I1	2	1	3	3	3	3	022	2	2	2	.0		02	1
NWG27B	A51	230	03	05	05	085	010	SM-SP	07.5YR4/4	S2	2	1	1	4	3	4	020	2	2	4			04	1
NWG28A	A40	030	00	00	15	080	005	SP-SW	10.0YR5/3	S2	2	1	1	2	3	2	014	2	1	1				1
NWG28B	A51	150	02	05	15	075	013	SM-SP	10.0YR5/6	S2	2	1	1	4	3	4	030	2	3	4	4.0	010	07	1
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NWG31B	A40	080	00	01	05	080	015	SC-SM	07.5YR5/4	S2	2	2	3	4	3	2	020	2	2	2	.3	071	03	1
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NWG34A	A5Y	130	00	02	40	050	010	SP-SM	10.0YR5/4	S2	2	1	1	2	2	1		2	1	5	1.5	010		
NWG34B	A5Y	080	00	0T	05	085	010	SW-SM	10.0YR5/4	S2	2	1	1	3	3	2	030	2	2	2	.5	003	03	1
NWG35A	A40		00	00	30	00T	100	CL	10.0YR4/1			1	4	4	1				1	5				1
NWG35B	A5Y	070	00	05	50	045	005	GW-GP		S2	2	1	1	2	3	2	030	2	2	2			02	1
NWG36A	A5Y		00	00	0T	095	005	SP-SM	10.0YR6/4	S2	2	2	1	2	3	1		2	1	4			4	1
NWG36B	A5Y	120	00	0T	05	085	010	SW-SM	07.5YR4/4	I2	2	1	2	4	2	1		2	3	1	.2	001	02	1
NWG37A	A40	100	00	05	20	075	005	SP-SM	10.0YR6/4	S2 I2 S4	2	2	1	2	2	2	015	2	2	1			02	1
NWG37B	A40		00	00	00	060	040	SM	07.5YR4/4		5	1	1	2	3	1			1	5	.1	001	02	1
NWG38A	A40		00	00	00	00T	100	CL	10.0YR4/1			1	4	4	1				1	5	15.0	044		1
NWG38B	A40	070	00	01	05	085	010	SM-SP	07.5YR6/4	I2	2	1	1	2	1	2	031	2	1	1	.3	004	02	1
NWG39B	A40	160	00	0T	10	075	015	SM	07.5YR5/4	I2	2	1	2	2	2	3	010	2	1	1				1
NWG40B	A40	100	00	0T	05	080	015	SM	10.0YR5/4	I2	2	1	2	2	2	2	031	2	2	2			01	2
NWG41A	A50	070	00	01	50	040	010	GP-GM		I2	4	1	1	2	2	2	020	2	2	2	2.0	005	02	1
NWG42B	A51	060	00	0T	05	010	085	CL	10.0YR5/6	S2	2	1	2	4	3	2	023	2	3	2				1
NWG43A	A5Y	010	00	00	05	045	050	ML-SM	10.0YR5/4	S2	2	1	2	2	3	4	031	2	2	4			01	1
NWG44B	A40		00	00	00	015	085	CL	10.0YR4/2			2	3	3	2	1			2	5	1.5	021	02	1
NWG45B	A40	010	00	20	05	075	020	SP-SM	10.0YR5/4	S2	5	1	1	3	3	1			1	4			02	1
NWG46B	A50	100	00	01	05	075	020	SM-SC	07.5YR4/4	I2	2	1	2	3	2	4	034	3	3	4			02	1
NWG47C	A51	070	00	0T	10	075	015	SM	07.5YR6/4	I2	2	2	1	3	3	3	027	2	3	4			02	1
NWG48B	A5Y	010	00	00	02	088	010	SP-SM	10.0YR5/3	I2	2	1	1	3	3	1		2	1	4			02	1
NWG49B	A51	050	00	00	05	077	020	SM	10.0YR5/6	S2	2	1	2	4	2	2	025	2	1	1	1.0	005	02	1

*PHYSICAL PROPERTIES :
6 - GRAIN SHAPE
7 - MOISTURE CONTENT
8 - PLASTICITY FINES
9 - CONSISTENCY
10 - STRUCTURE
11 - CEMENTATION-INDURATION
12 - DEPTH TO CEMENTED LAYER(CM)
13 - WEATHERING OF CLASTS
14 - SOIL PROFILE DEVELOPMENT
15 - CALICHE DEVELOPMENT

RNRPT PRINTS

GEOLOGIC STATION DATA
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE 1-1

FUGRO NATIONAL, INC.

SECTION 2.0

GROUND-WATER DATA

EXPLANATIONS OF GROUND-WATER DATA

Existing ground-water data were collected from all available sources. These data were updated where possible from measurements taken during Fugro field operations, and all data are shown on Table 2-1. Locations of water wells and boreholes in which water-level measurements were available are shown in Drawing 1. Well numbers listed in Column 1 (Table 2-1) refer to well locations in Drawing 1. Actual well numbers giving location according to the Bureau of Land Management Land Survey System are shown in Column 2.

Water levels generally refer to the static ground-water table in the unconfined basin-fill aquifer. Perched conditions or levels in artesian aquifers are noted where known.

WELL NO.	WELL LOCATION NUMBER*	ELEVATION OF GROUND SURFACE - FEET (METERS) ABOVE M.S.L.	DEPTH OF WELL - FEET (METERS)	WATER LEVEL			REFERENCES**/ REMARKS
				DEPTH BELOW GROUND SURFACE - FEET (METERS)	DATE MEASURED	ELEVATION - FEET (METERS) ABOVE M.S.L.	
W1	14S/11W-29c	5600 (1707)	-	100 (30)	-	5500 (1676)	2, In Rock
W2	14S/12W-34d	5193 (1583)	-	700-800 213-244	- -	4393-4493 (1339-1370)	2
W3	15S/12W-20b	5190 (1582)	-	800 (244)	- -	4390 (1338)	2
W4	15S/12W-25	5210 (1588)	-	800 (244)	-	4410 (1344)	2
W5	16S/11W-17d	5145 (1568)	-	700 (213)	-	4445 (1355)	2
W6	17S/10W-14bb	4649 (1417)	204 (62)	116 (35)	1963	4533 (1382)	1, 3
W7	17S/10W-20c	4770 (1454)	-	200-300 (61-91)	-	4470-4570 (1363-1393)	2
W8	17S/11W-3c	4950 (1509)	-	250-350 (76-107)	-	4600-4700 (1402-1433)	2
W9	18S/10W-3	4625 (1410)	-	100-200 (30-61)	-	4425-4525 (1349-1379)	2
W10	18S/10W-26bda	4580 (1396)	280 (85)	48 (15)	1951	4532 (1381)	1, 3
W11	18S/10W-28	4620 (1408)	-	100-200 (30-61)	-	4420-4520 (1347-1378)	2
W12	18S/11W-5dbb	4880 (1487)	565 (172)	250 (76)	1935	4630 (1411)	1
W13	18S/12W-5	5390 (1643)	542 (165)	250 (76)	1935	5140 (1567)	3
W14	19S/10W-6d	4680 (1427)	592 (180)	190 (58)	-	4490 (1369)	2
W15	19S/11W-21d	4765 (1452)	-	215 (66)	-	4550 (1387)	2
W16	19S/11W-28bad	4670 (1423)	524 (160)	217 (66)	1951	4453 (1357)	3

*Salt Lake Baseline and Meridian

**References:

1. Mower and Feltis (1964)
2. Snyder (1963) - All depths to water are estimated
3. Utah State Engineers Office (1979)

NOTE: All wells tap unconfined alluvial aquifers except where noted. Where published data are lacking or inaccurate, ground surface elevations are taken from topographic maps.

GROUND-WATER DATA
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE 2-1 1 OF 2

UGRO NATIONAL, INC.

WELL NO.	WELL LOCATION NUMBER*	ELEVATION OF GROUND SURFACE - FEET (METERS) ABOVE M.S.L.	DEPTH OF WELL - FEET (METERS)	WATER LEVEL			REFERENCES**/ REMARKS
				DEPTH BELOW GROUND SURFACE - FEET (METERS)	DATE MEASURED	ELEVATION - FEET (METERS) ABOVE M.S.L.	
W17	19S/12W-27d	4700 (1433)	-	250-350 (76-107)	-	4350-4450 (1326-1356)	2
W18	19S/12W-30abb	5090 (1551)	560 (171)	DRY	1936	4530+ (1381+)	1, 3
W19	21S/13W-1a	4720 (1286)	176 (54)	DRY	-	4544+ (1385+)	2
W20	21S/13W-10	4980 (1518)	660 (201)	422 (129)	1935	4558 (1389)	3, In Rock
W21	22S/12W-20b	4560 (1390)	-	200-300 61-91	-	4260-4360 (1298-1329)	2

* Salt Lake Baseline and Meridan

** References:

1. Mower and Feltis (1964)
2. Snyder (1963) - All depths to water are estimated
3. Utah State Engineers Office (1979)

NOTE: All wells tap unconfined alluvial aquifers except where noted. Where published data are lacking or inaccurate, ground surface elevations are taken from topographic maps.

GROUND-WATER DATA
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE 2-1 2 OF 2

UGRO NATIONAL, INC.

SECTION 3.0

SEISMIC REFRACTION DATA

EXPLANATIONS OF SEISMIC REFRACTION DATA

Each figure shows seismic wave travel times plotted versus surface distance between the energy source (shot) and the detector (geophone) for a single seismic line. Distances are measured along the line from geophone number 1 which is designated as zero distance. Distances to the right (on the paper) of geophone 1 are positive. The direction arrow gives the approximate direction of the geophone array from geophone 1 to geophone 24.

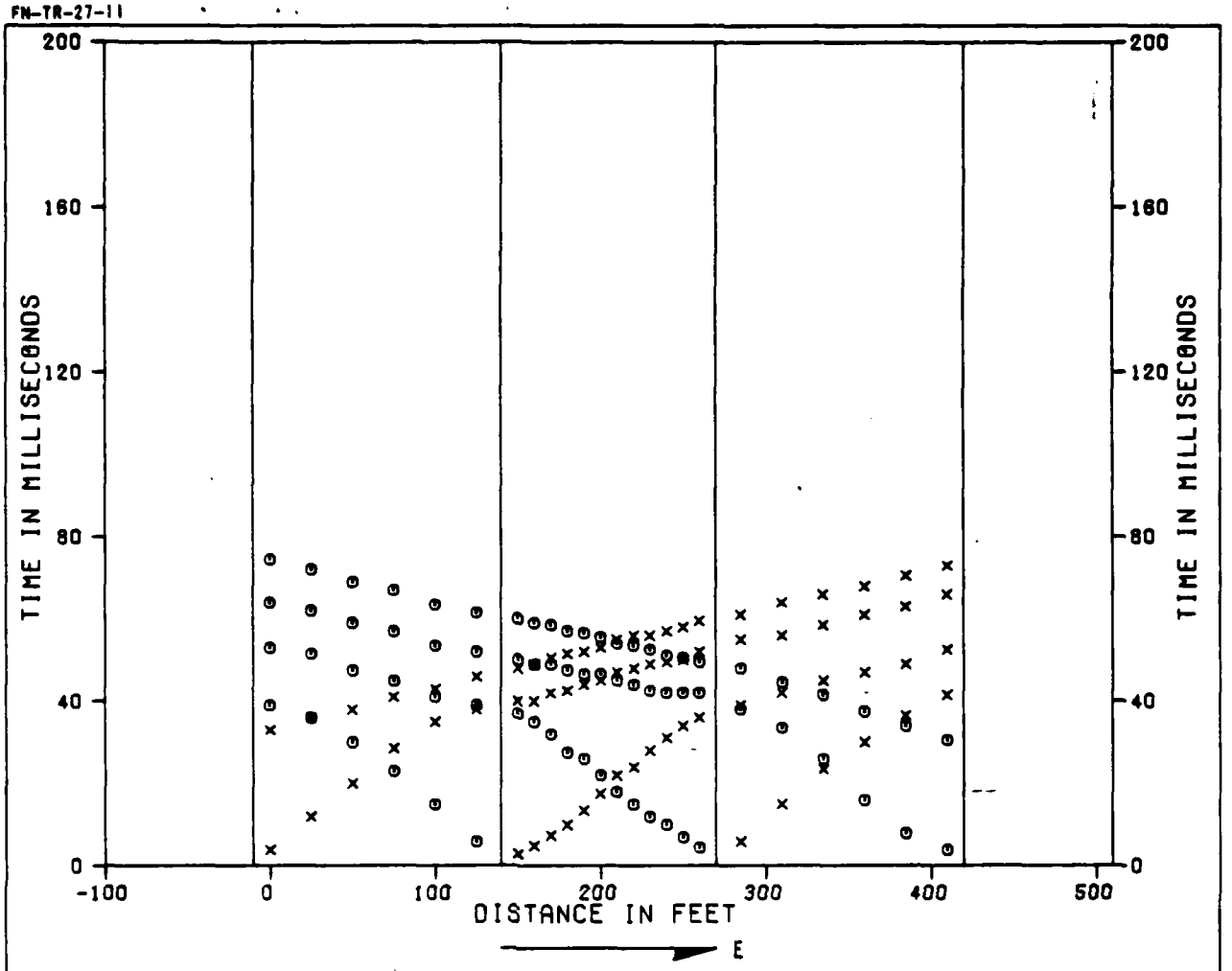
Travel Time Versus Distance Graph (Upper Half of Figure)

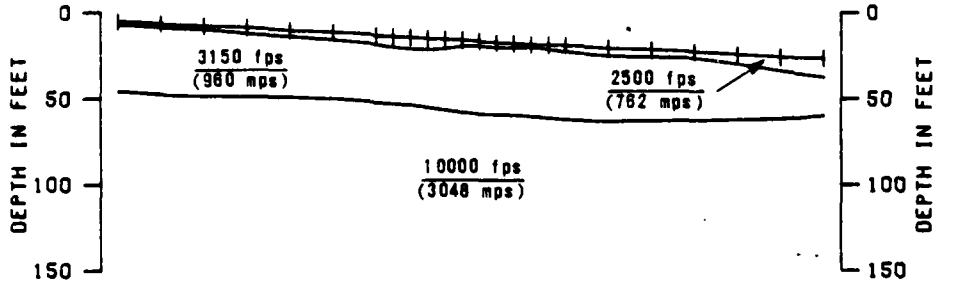
This is a travel time versus distance graph. The abscissa represents distance; the ordinate, time. The six vertical lines represent the locations of shots (designated as F, G, H, I, J, and K). The symbol, X, denotes travel times at geophones that were located to the right of a shot. The symbol, ⊙, denotes travel times that were located to the left of shots.

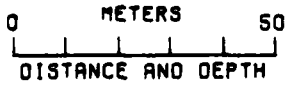
Velocity Cross Section (Lower Half of Figure)

This is an interpreted velocity cross section beneath the seismic line. The top line represents the ground-surface profile. The short vertical lines crossing the top line mark the geophone positions. The depth scale is plotted relative to a point on the line which was arbitrarily chosen as "zero elevation" at the time the line was surveyed. The additional lines across the cross section represent the interpreted boundaries between layers of material with different compressional wave velocities. These boundaries are commonly called "refractors". The velocity interpreted to be representative of each layer is shown.

FN-TR-27-11







× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-1
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
3-1

FUGRO NATIONAL, INC.

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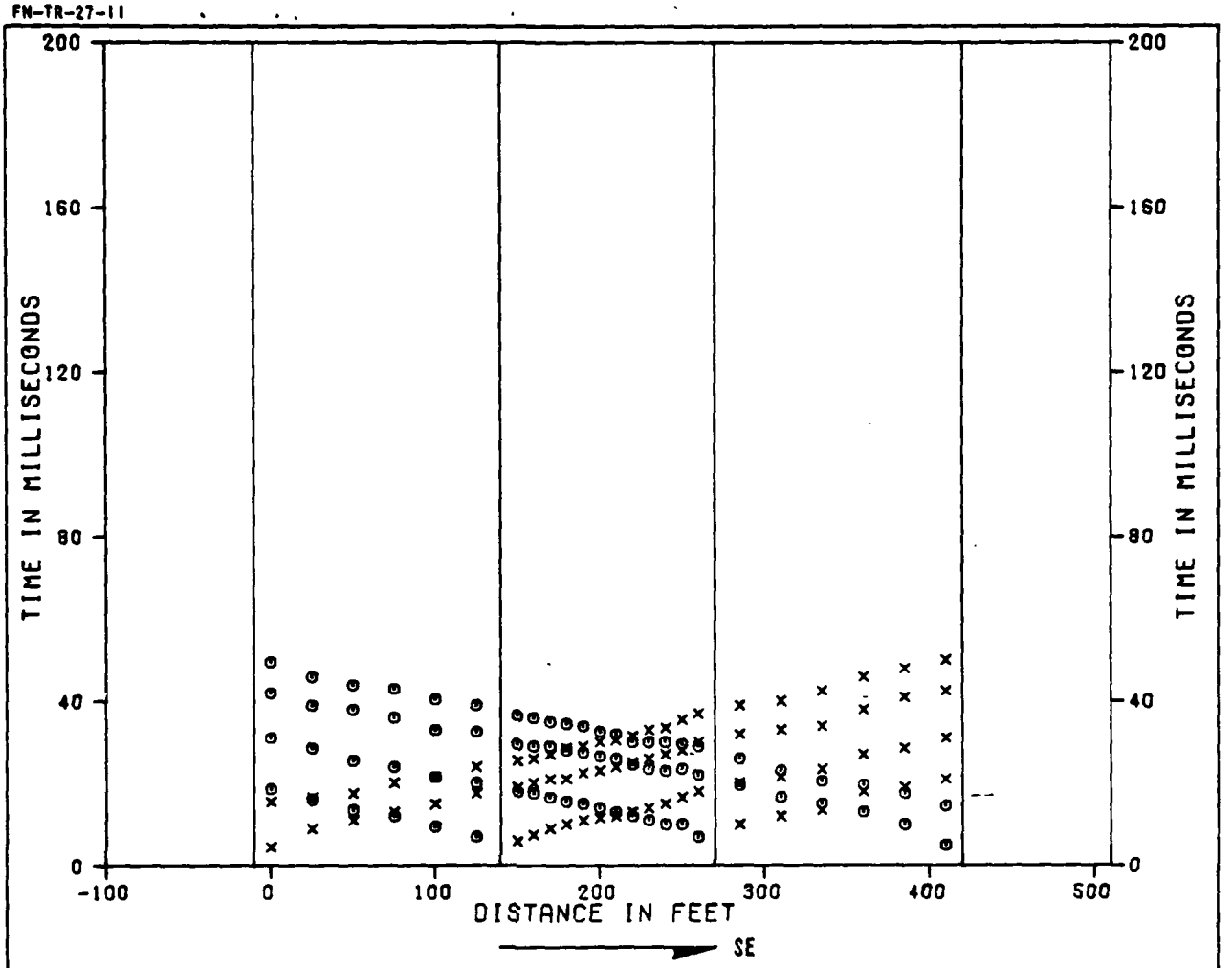

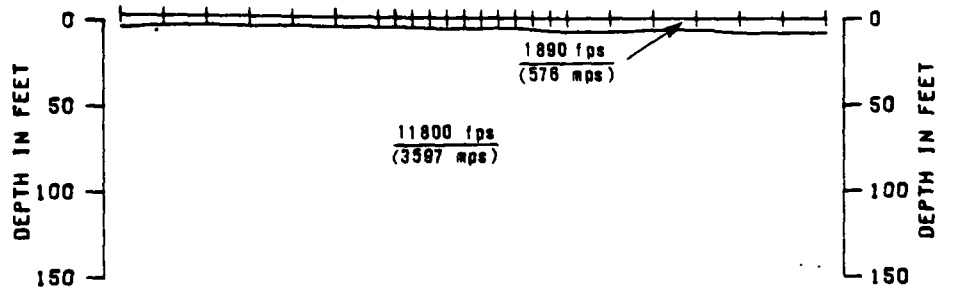

0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-2
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-2

FUGRO NATIONAL, INC.

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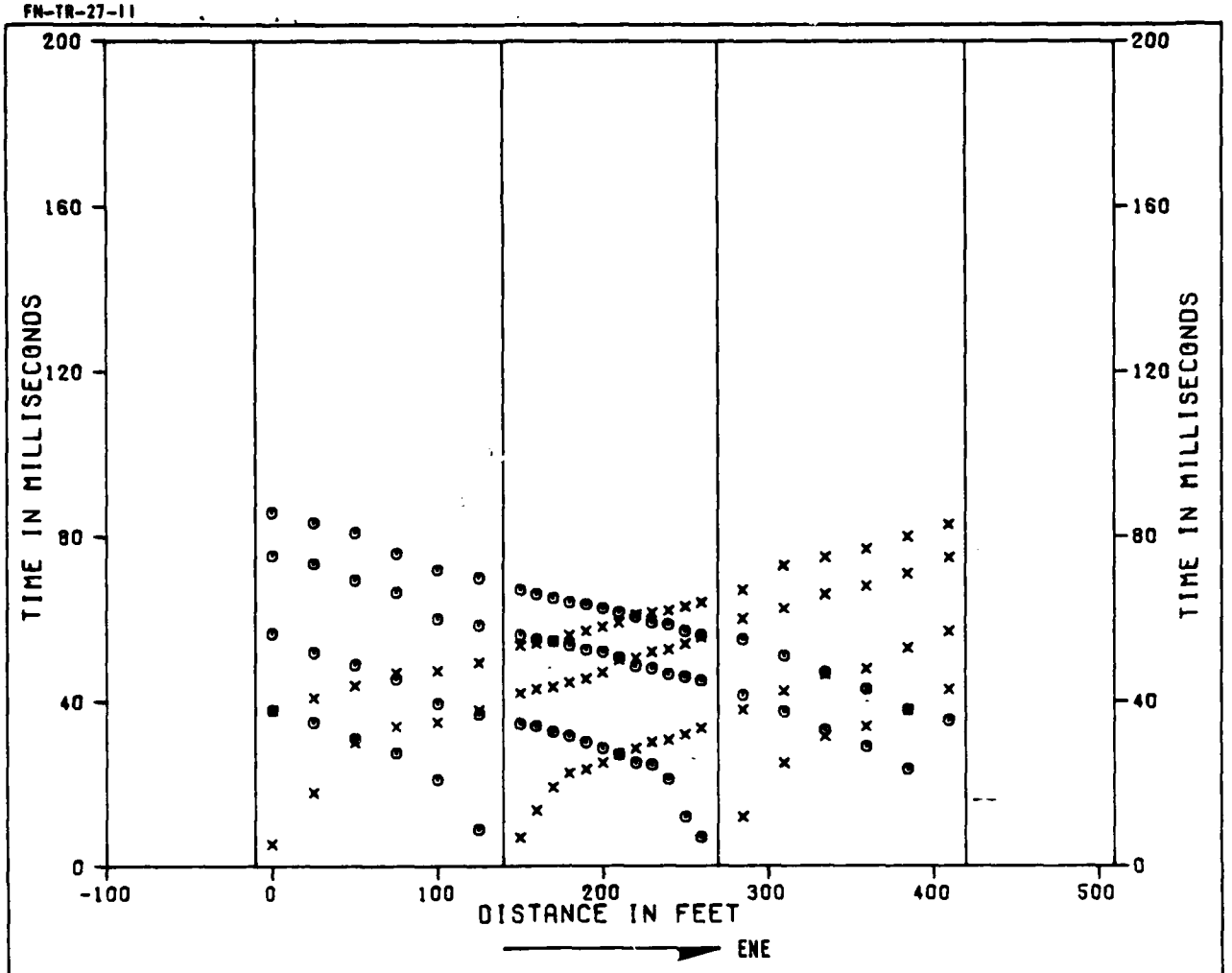

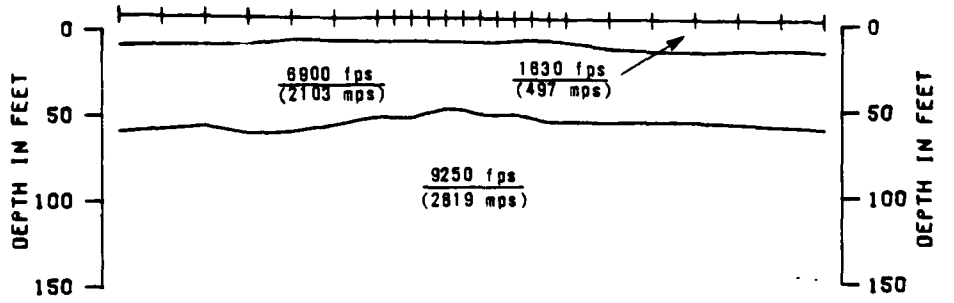

0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-3
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-3

UGRO NATIONAL, INC.

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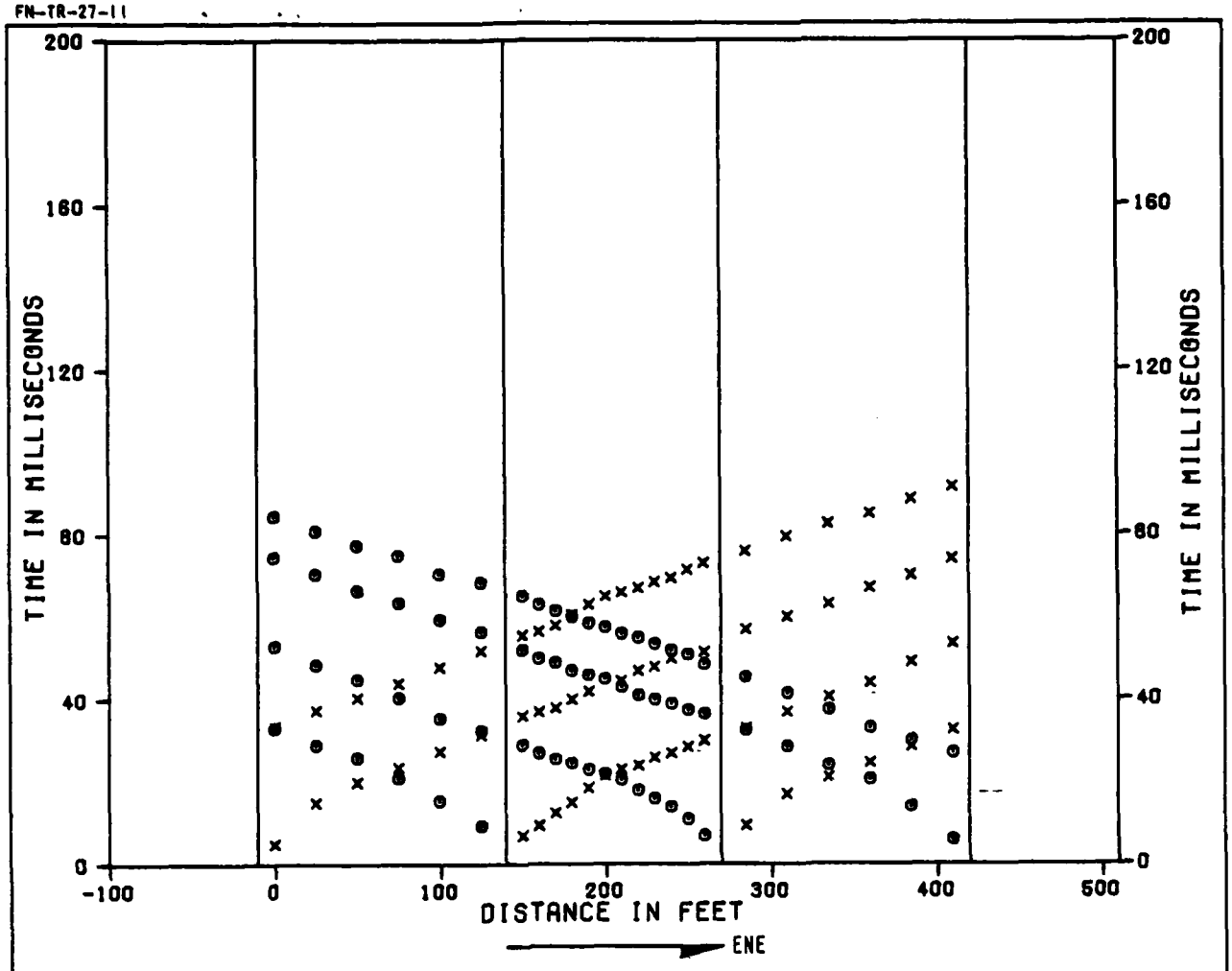

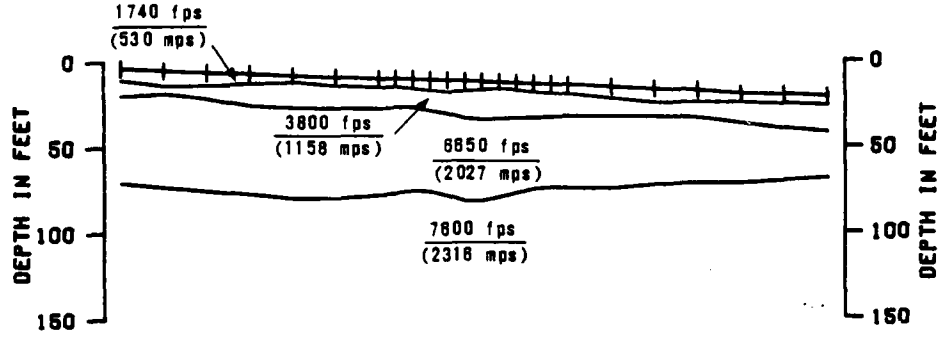

0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-4
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-4

FUGRO NATIONAL, INC.

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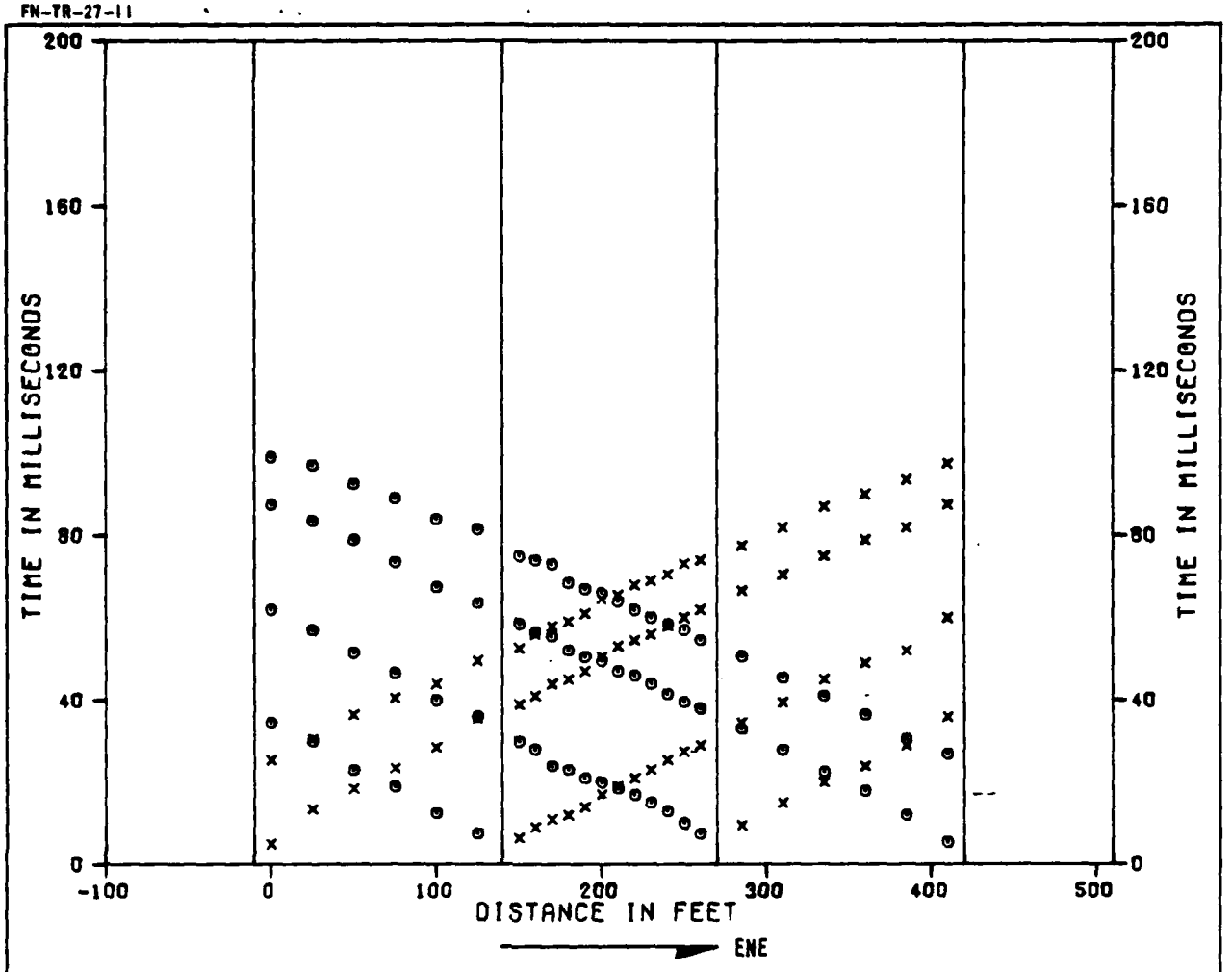

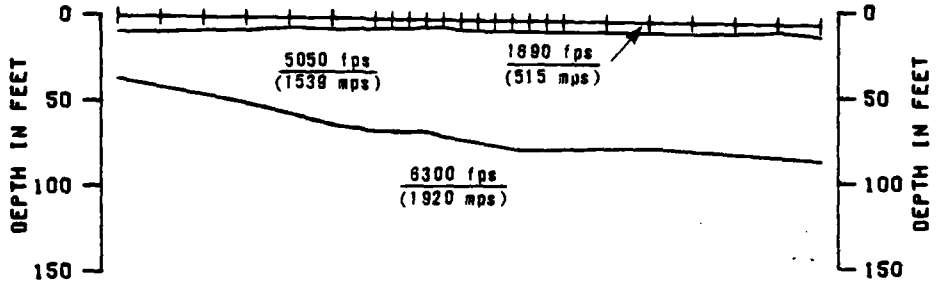

0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-5
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-5

FUGRO NATIONAL, INC.

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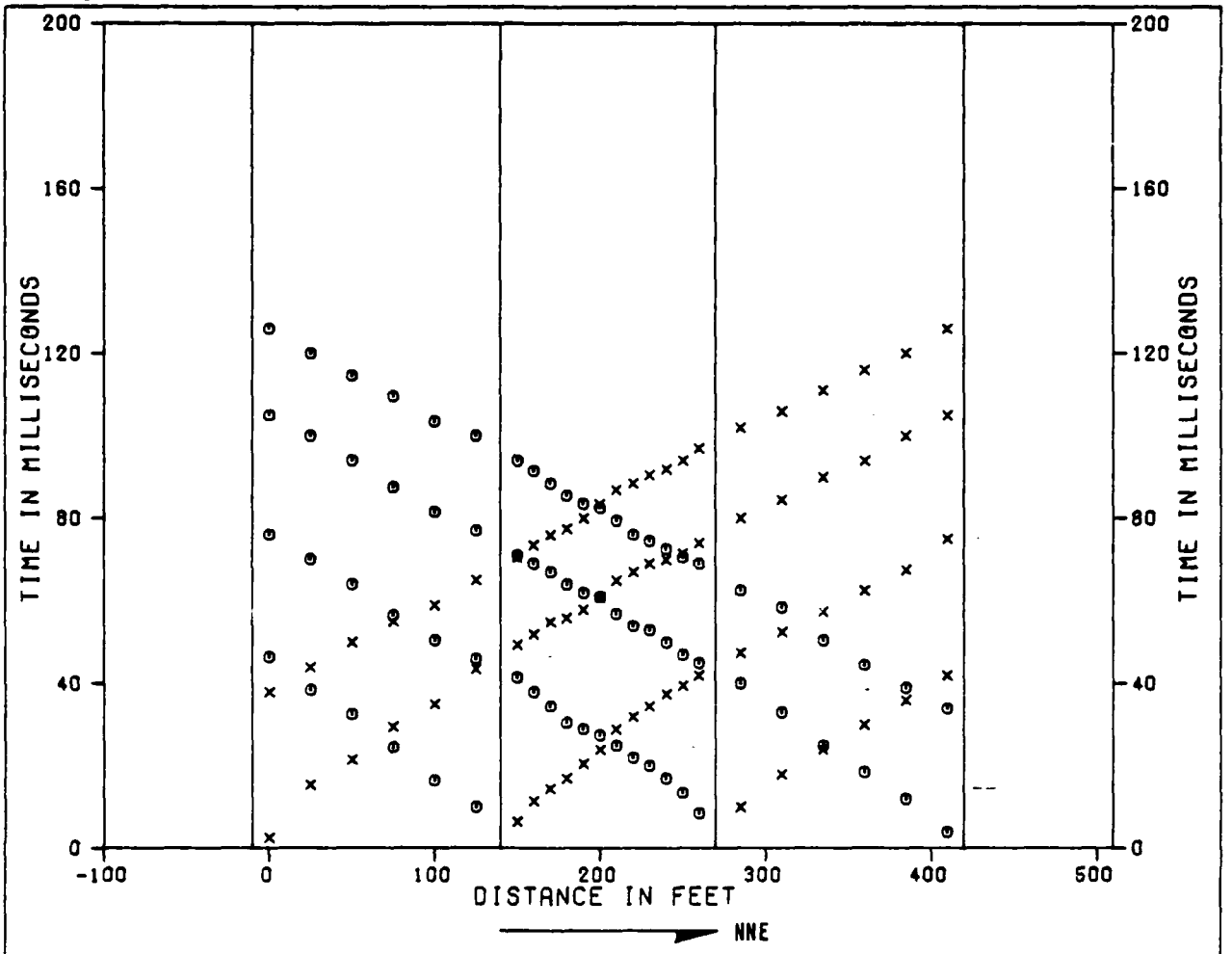

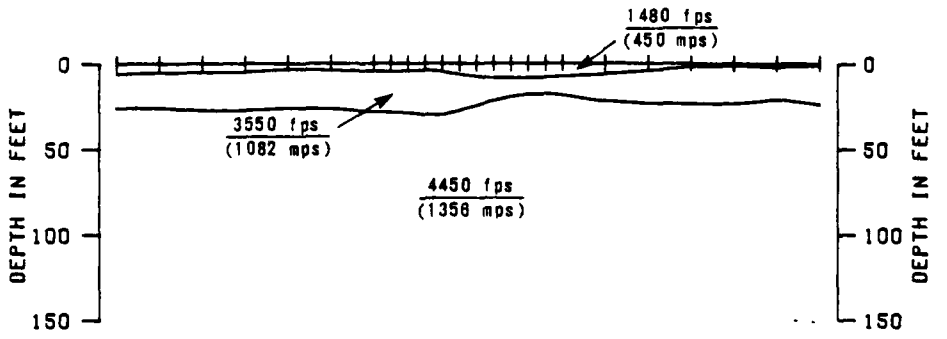

0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-6
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE. WHIRLWIND CDP. UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-6

UGRO NATIONAL, INC.

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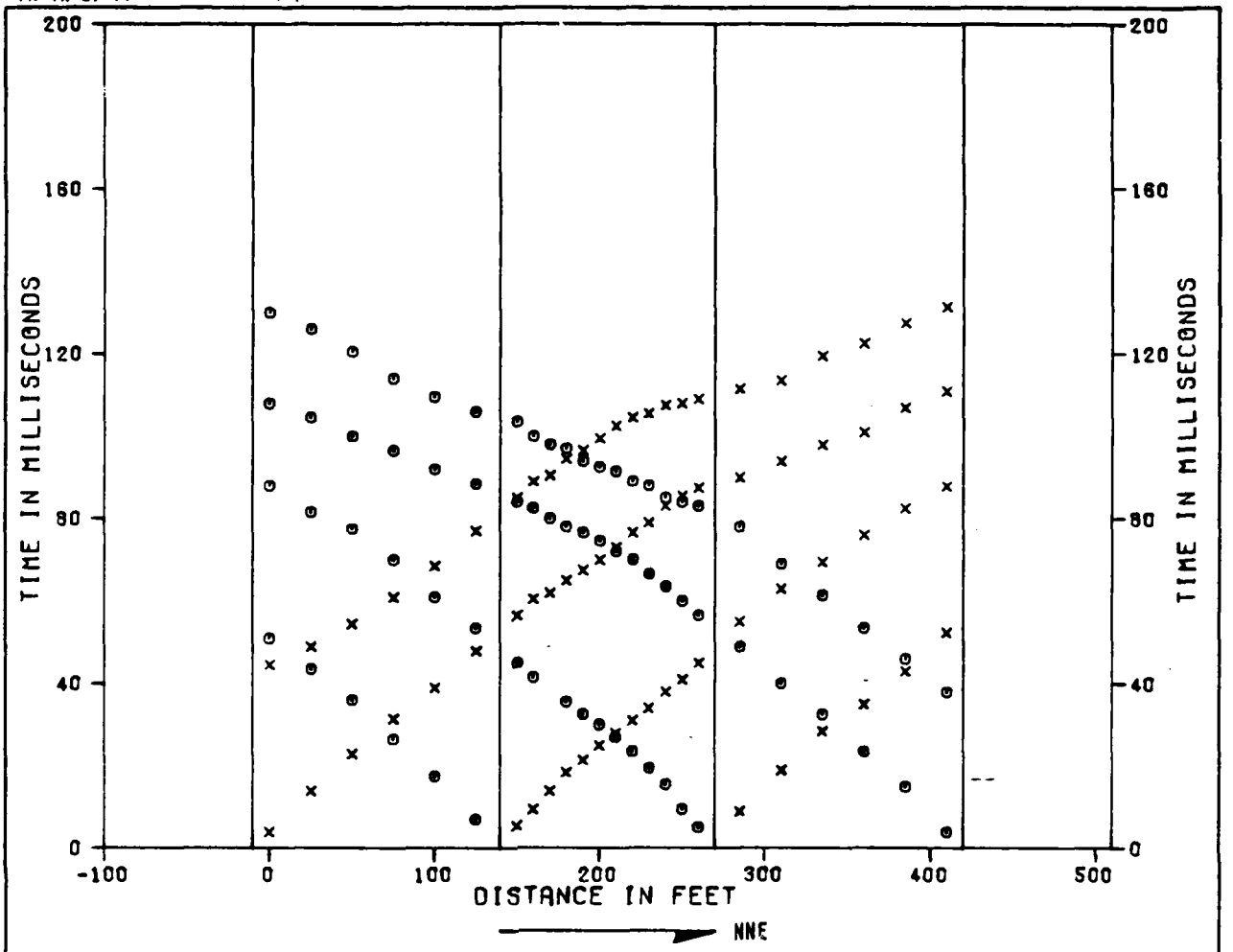

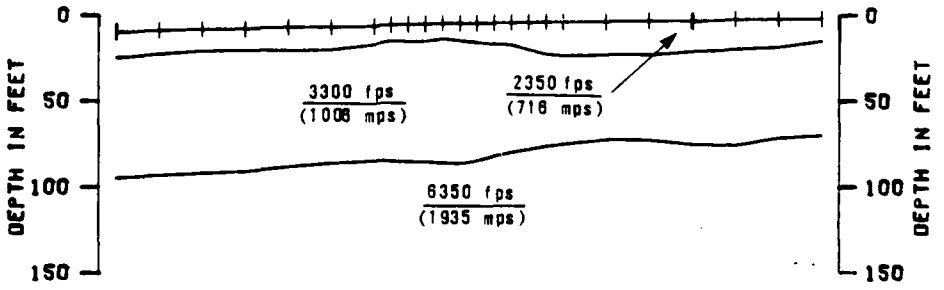

0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-7
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-7

FUGRO NATIONAL, INC.

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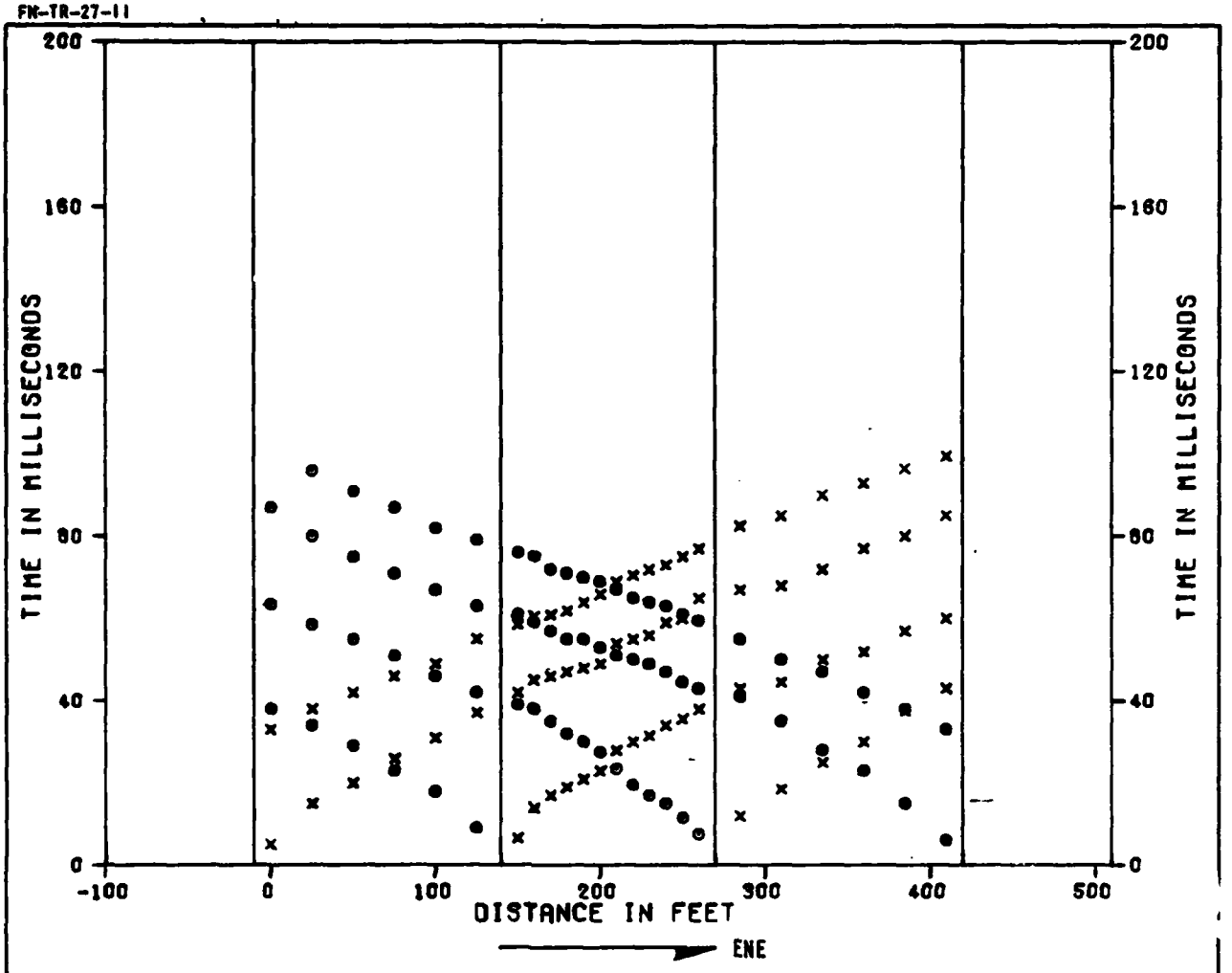

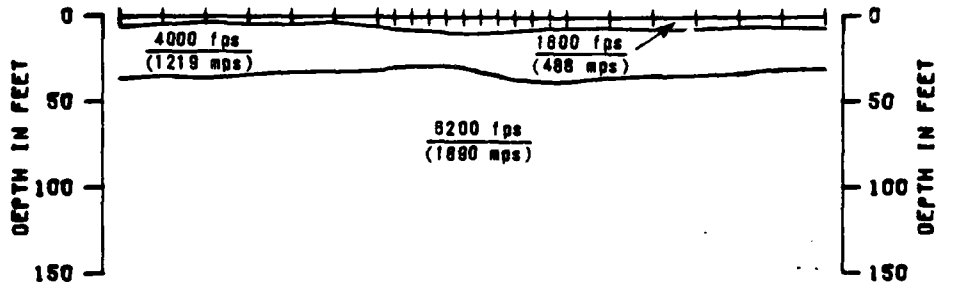

0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

● TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-8
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-8

FUGRO NATIONAL, INC.

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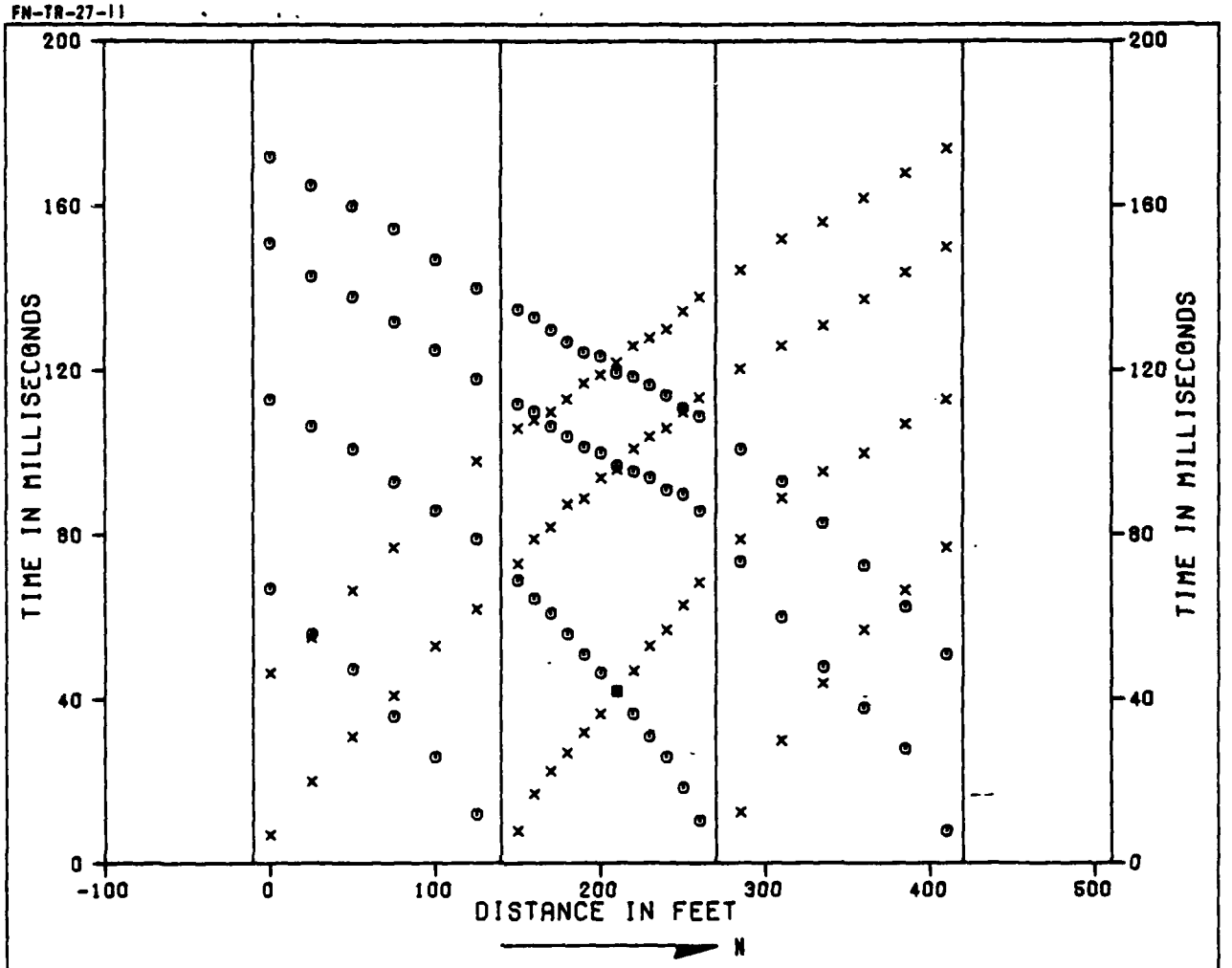

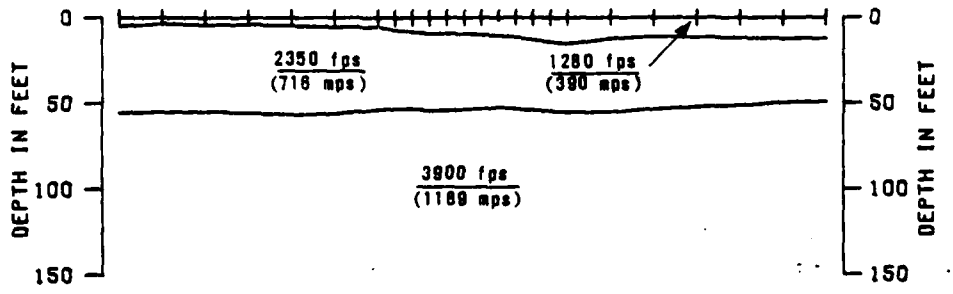

0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-9
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-9

FUGRO NATIONAL, INC.

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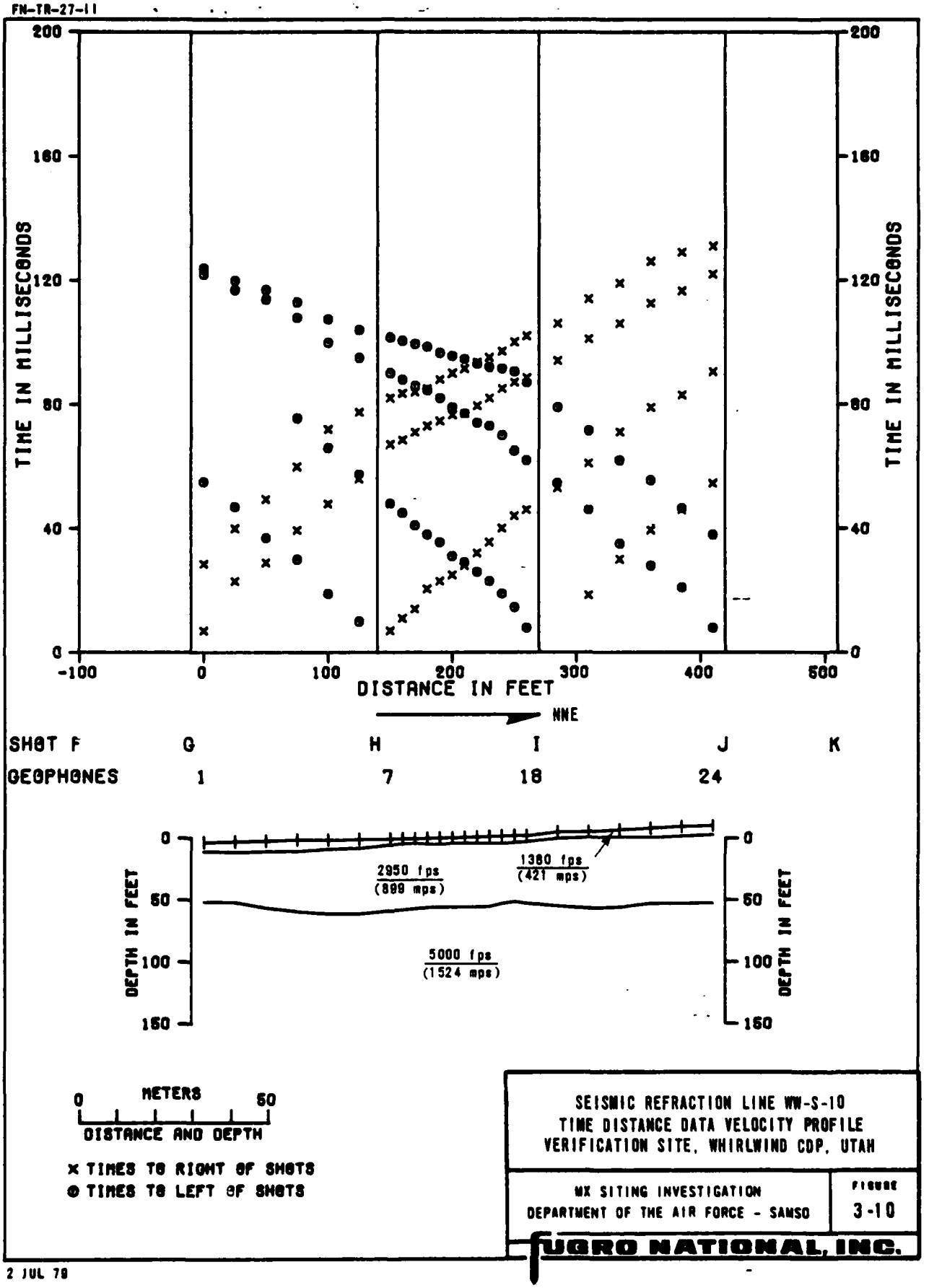

SEISMIC REFRACTION LINE WW-S-10
TIME DISTANCE DATA VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-10

FUGRO NATIONAL, INC.

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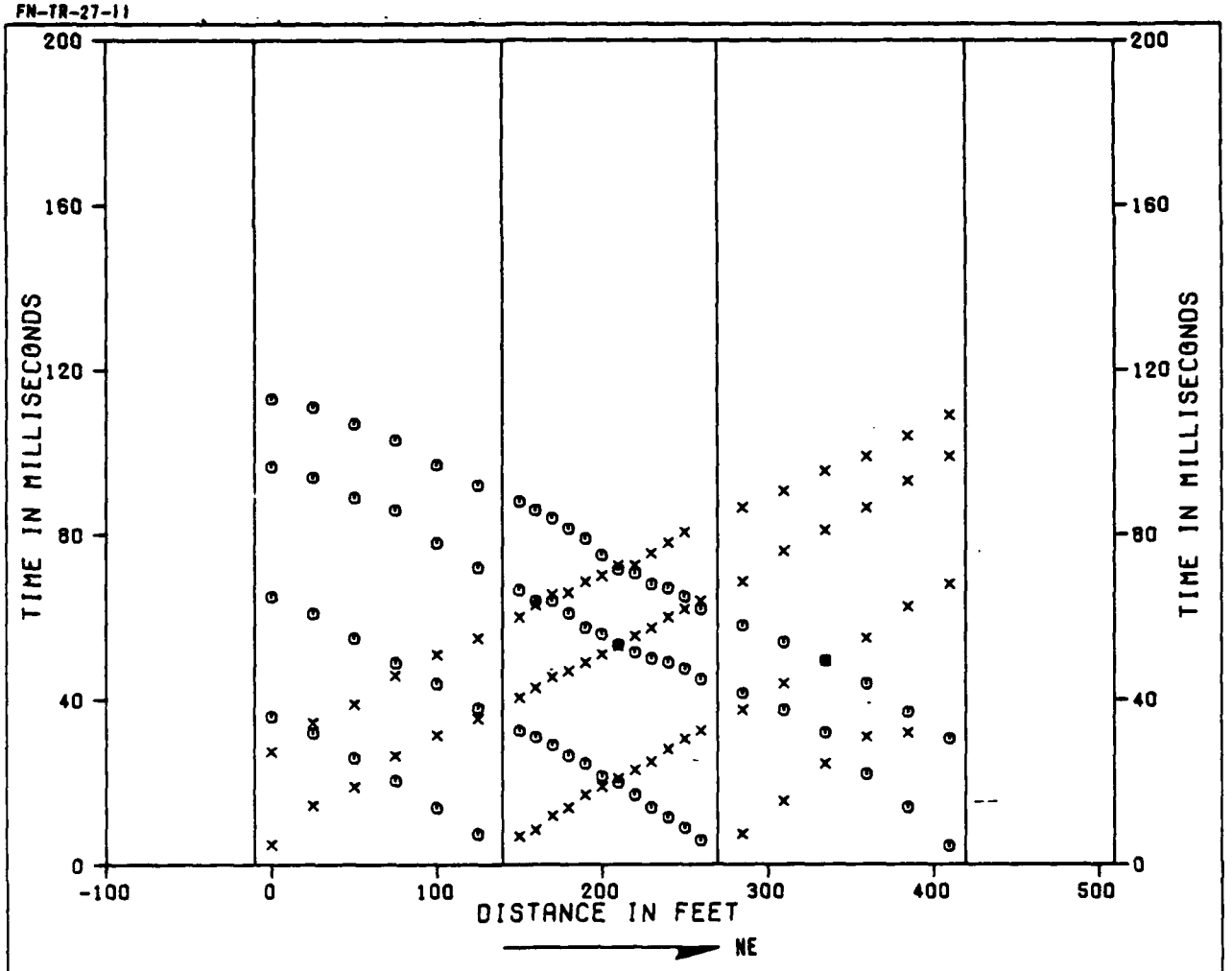
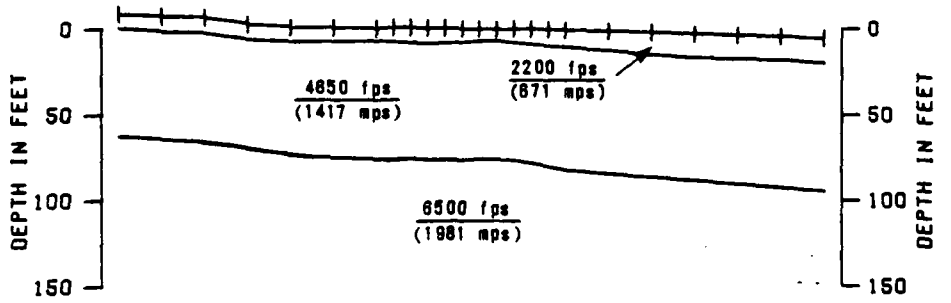
FN-TR-27-11





0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-11
TIME DISTANCE DATA VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-11

FUGRO NATIONAL, INC.

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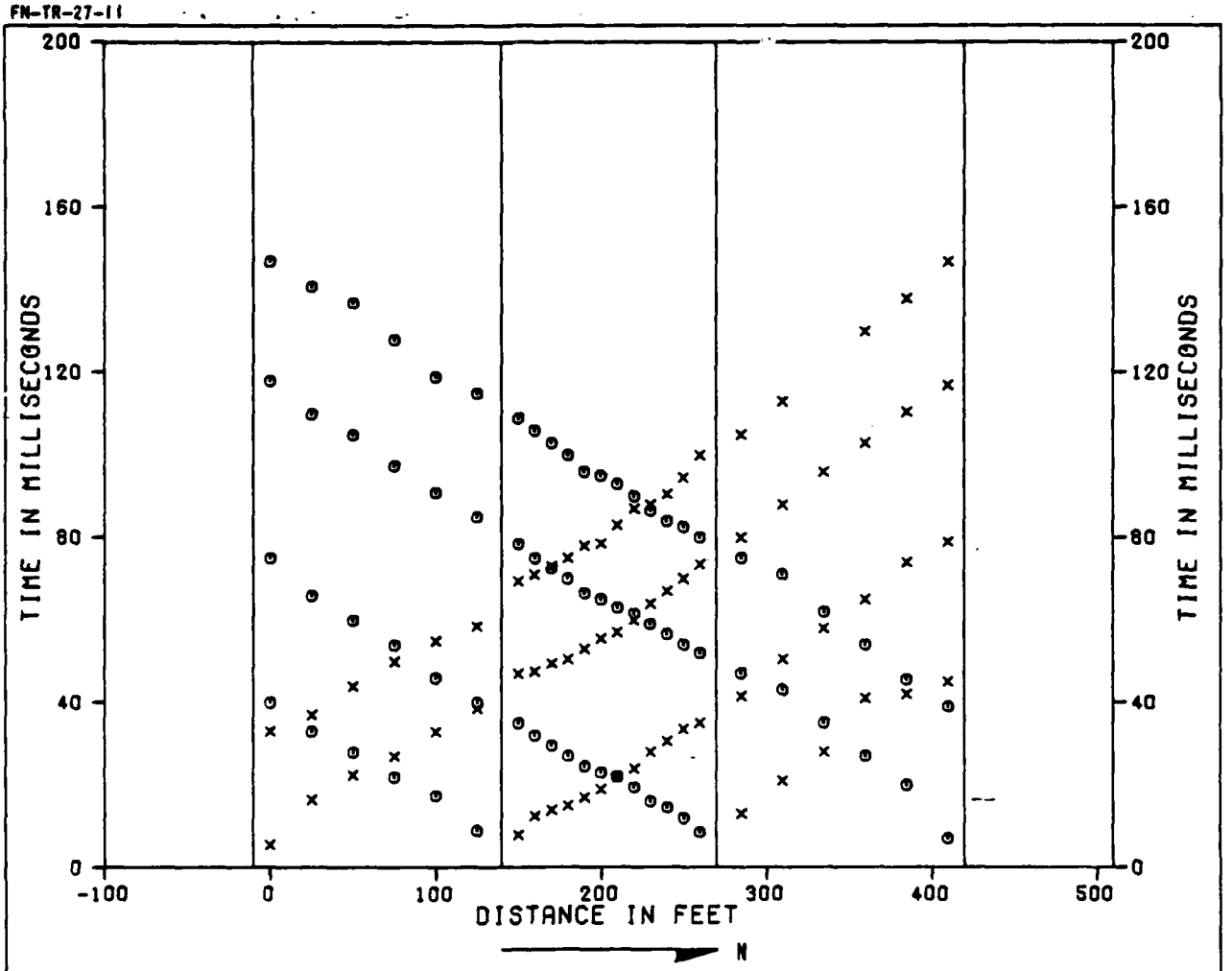
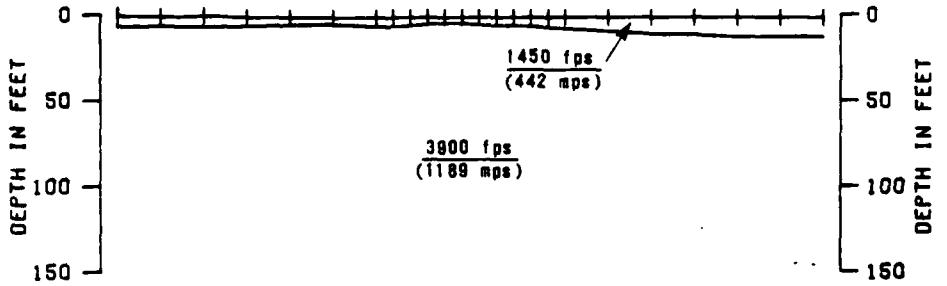
FN-TR-27-11





0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-12
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND CDP, UTAH

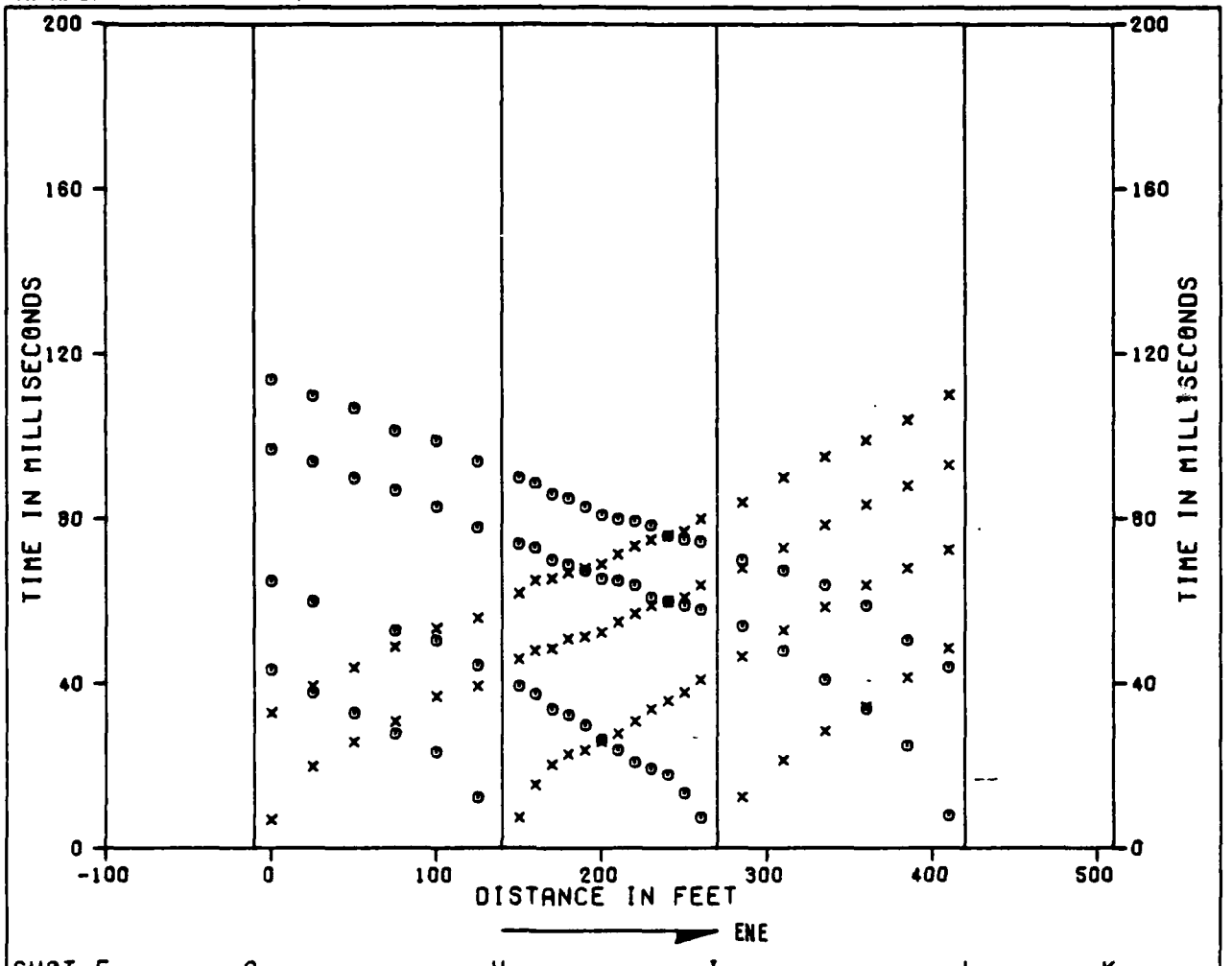
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

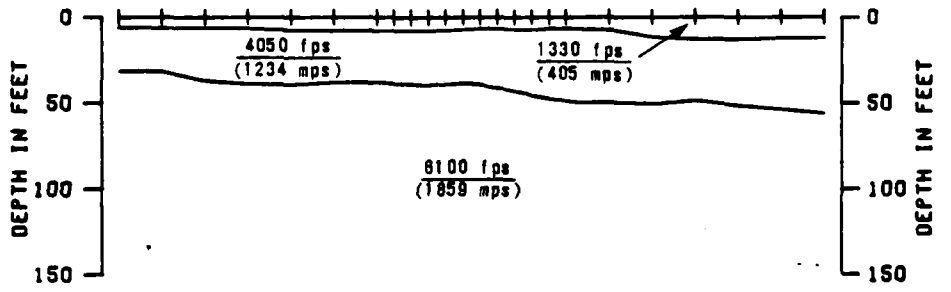
FIGURE
3-12

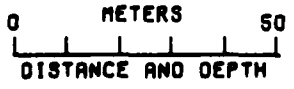
FUGRO NATIONAL, INC.

2 JUL 79

FN-TR-27-11







× TIMES TO RIGHT OF SHOTS
⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTON LINE WW-S-13
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-13

FUGRO NATIONAL, INC.

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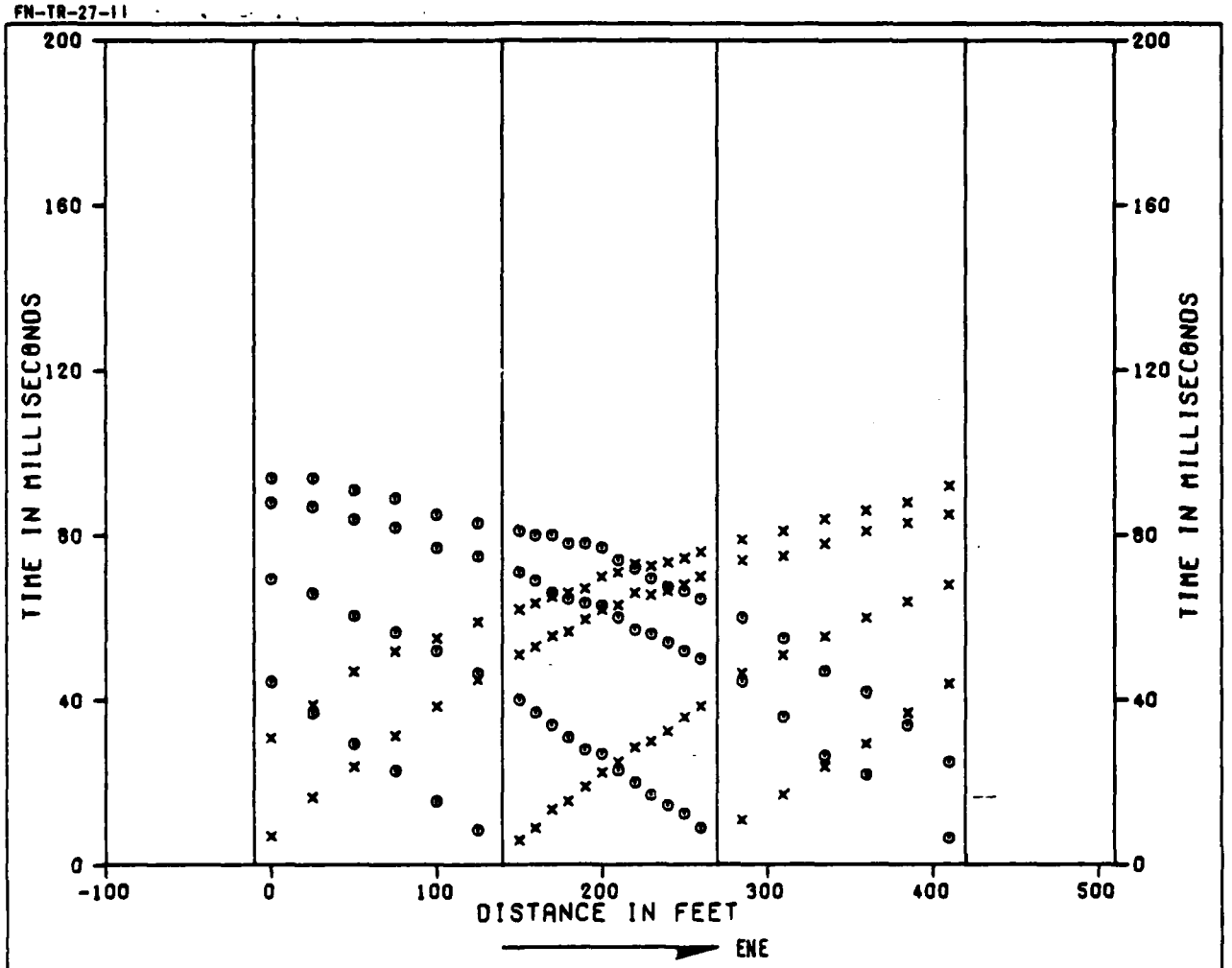
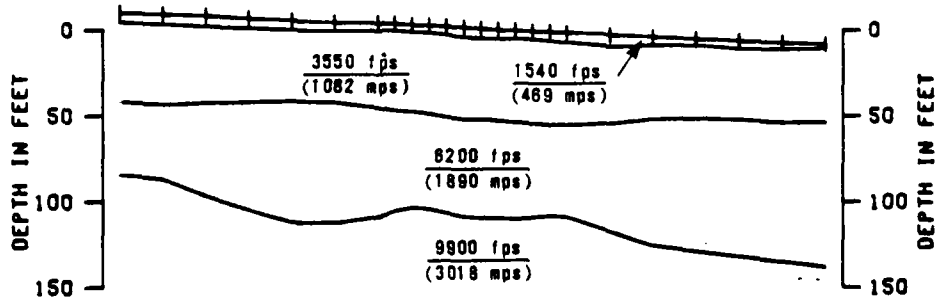
FN-TR-27-11





0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-14
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-14

UGRO NATIONAL, INC.

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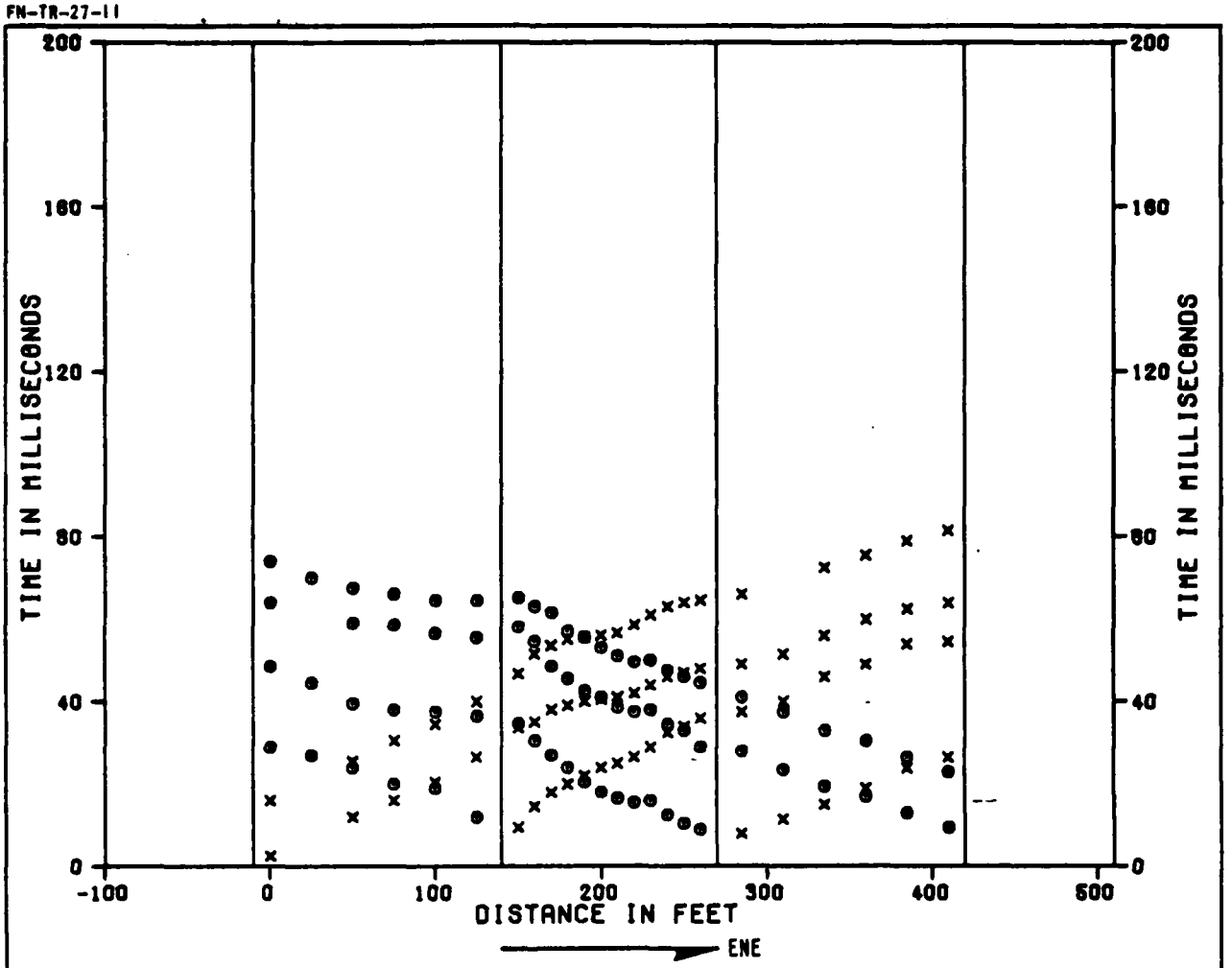
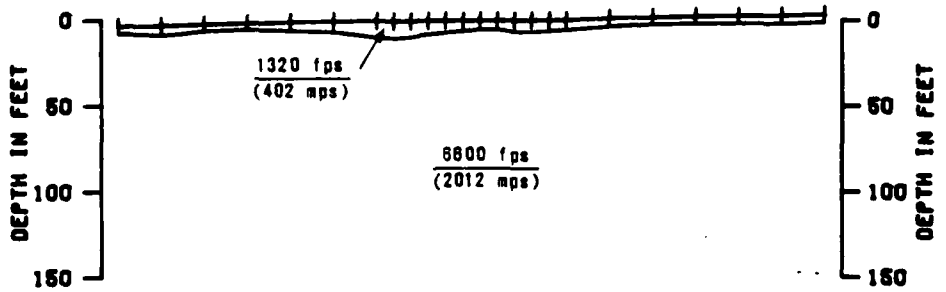
FN-TR-27-11





0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

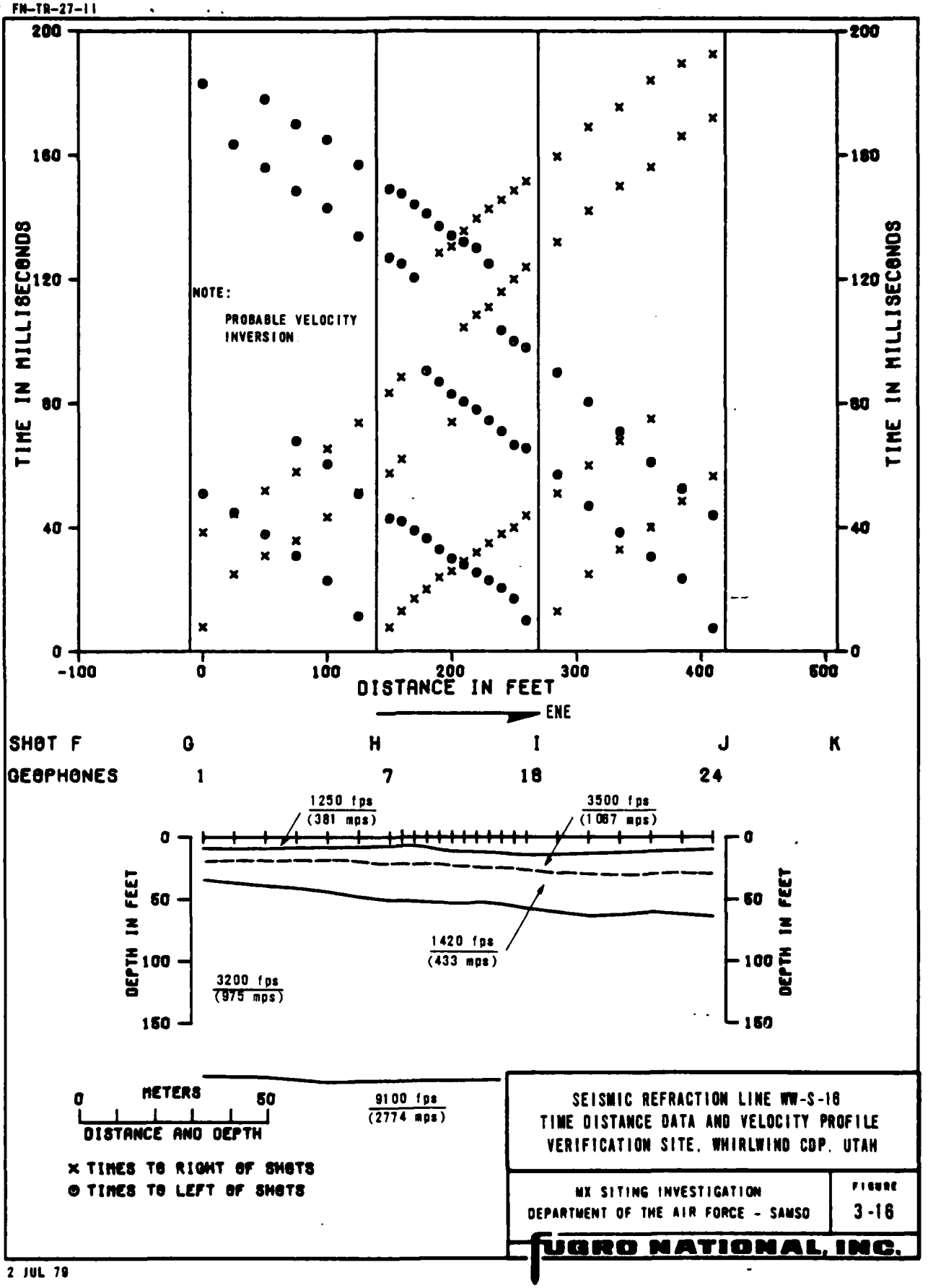
SEISMIC REFRACTION LINE WW-S-15
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-15

UGRO NATIONAL, INC.

2 JUL 79



SEISMIC REFRACTION LINE WW-S-16
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND CDP, UTAH

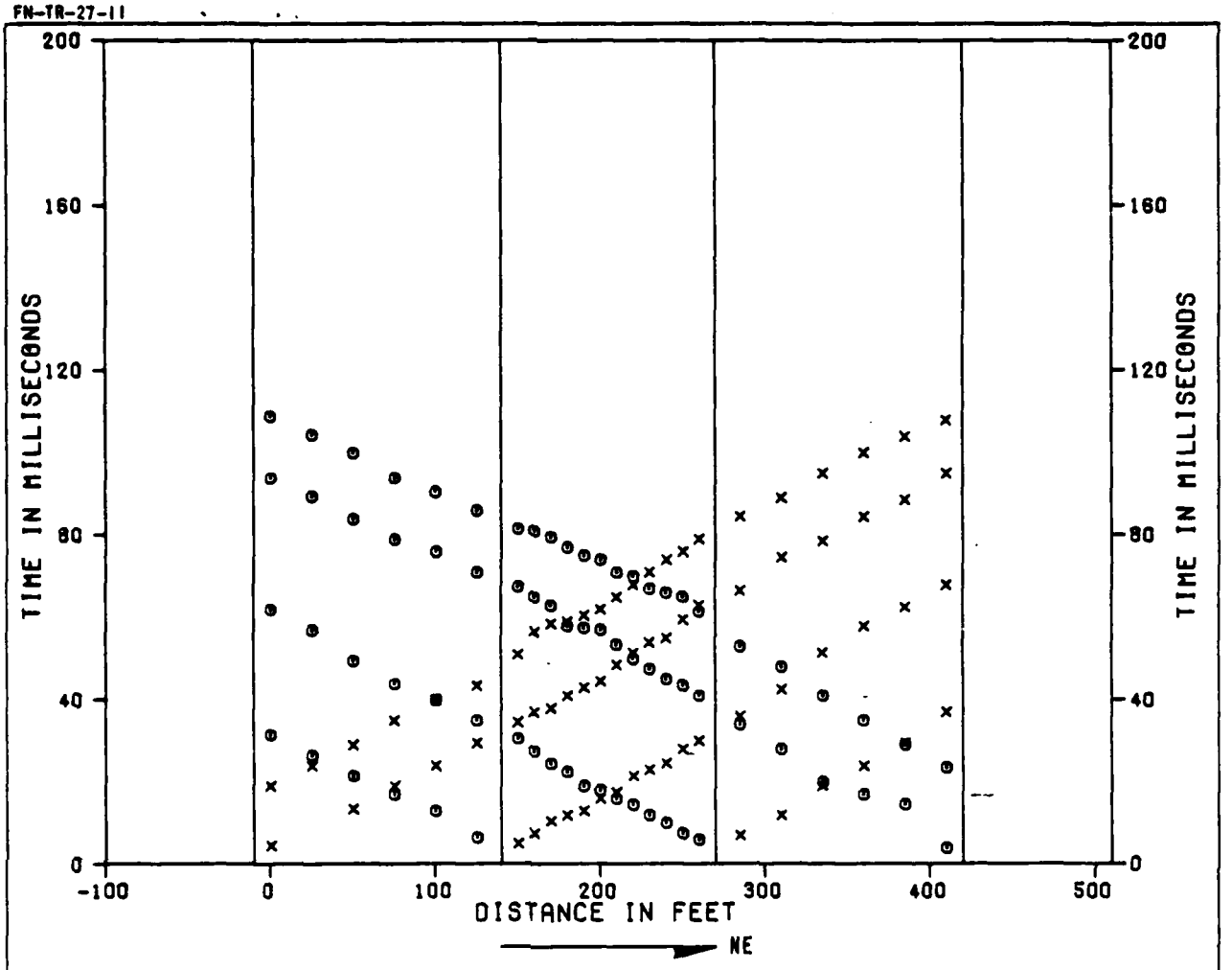
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

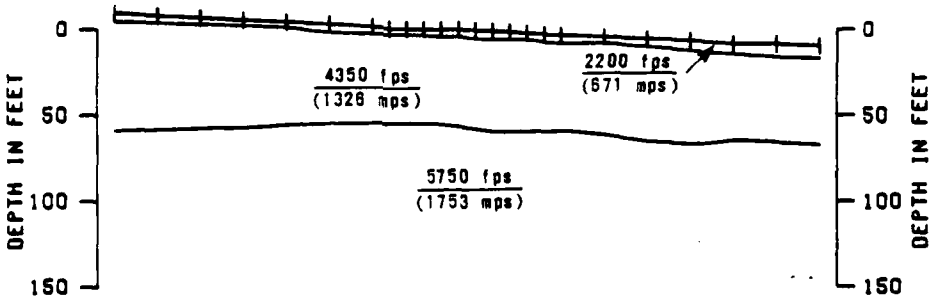
FIGURE
3-16

FUGRO NATIONAL, INC.

2 JUL 79

FN-TR-27-11





0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-17
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-17

FUGRO NATIONAL, INC.

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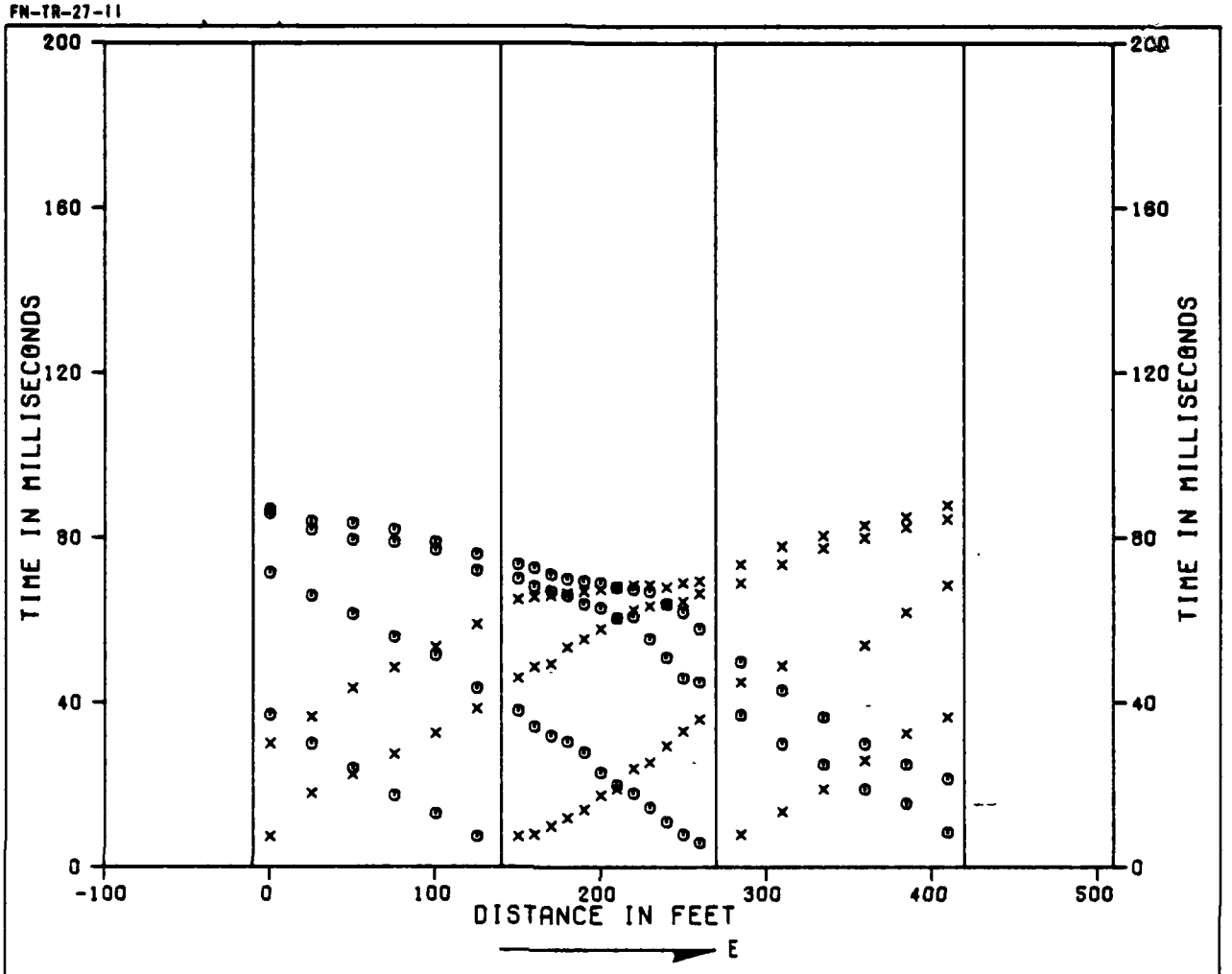
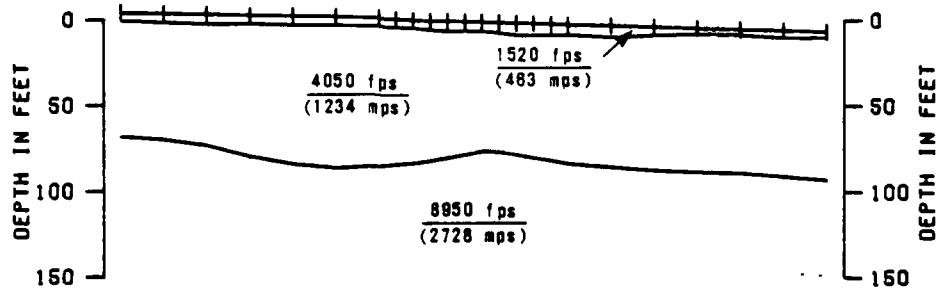
FN-TR-27-11





0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-18
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND COP, UTAH

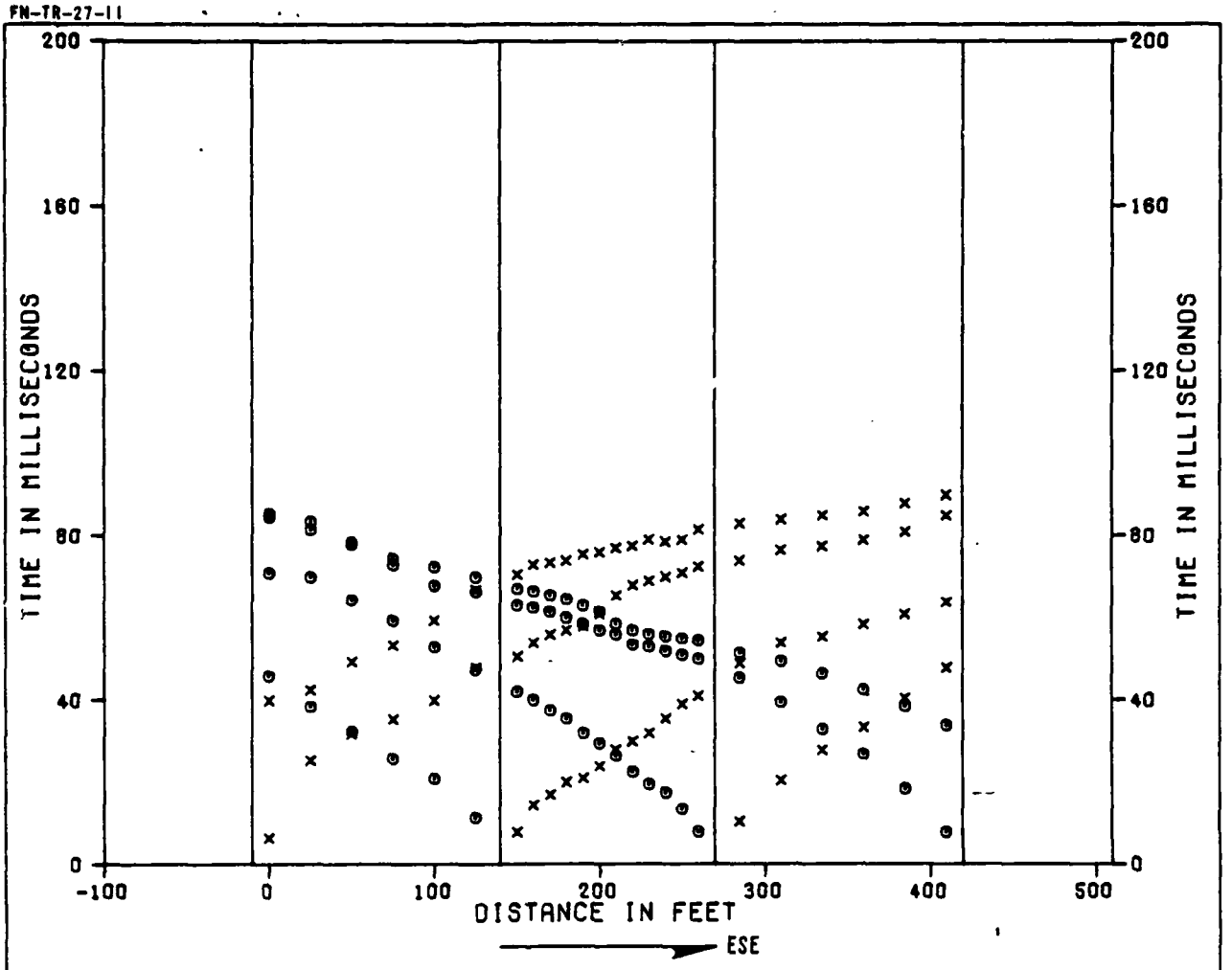
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

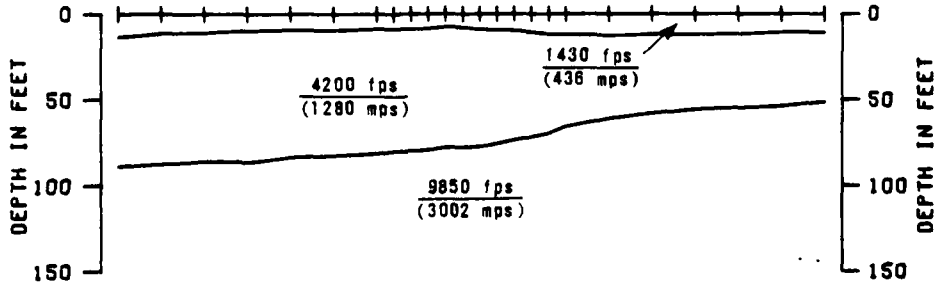
FIGURE 3-18

UGRO NATIONAL, INC.

2 JUL 78

FN-TR-27-11





0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-19
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFICATION SITE, WHIRLWIND CDP UTAH

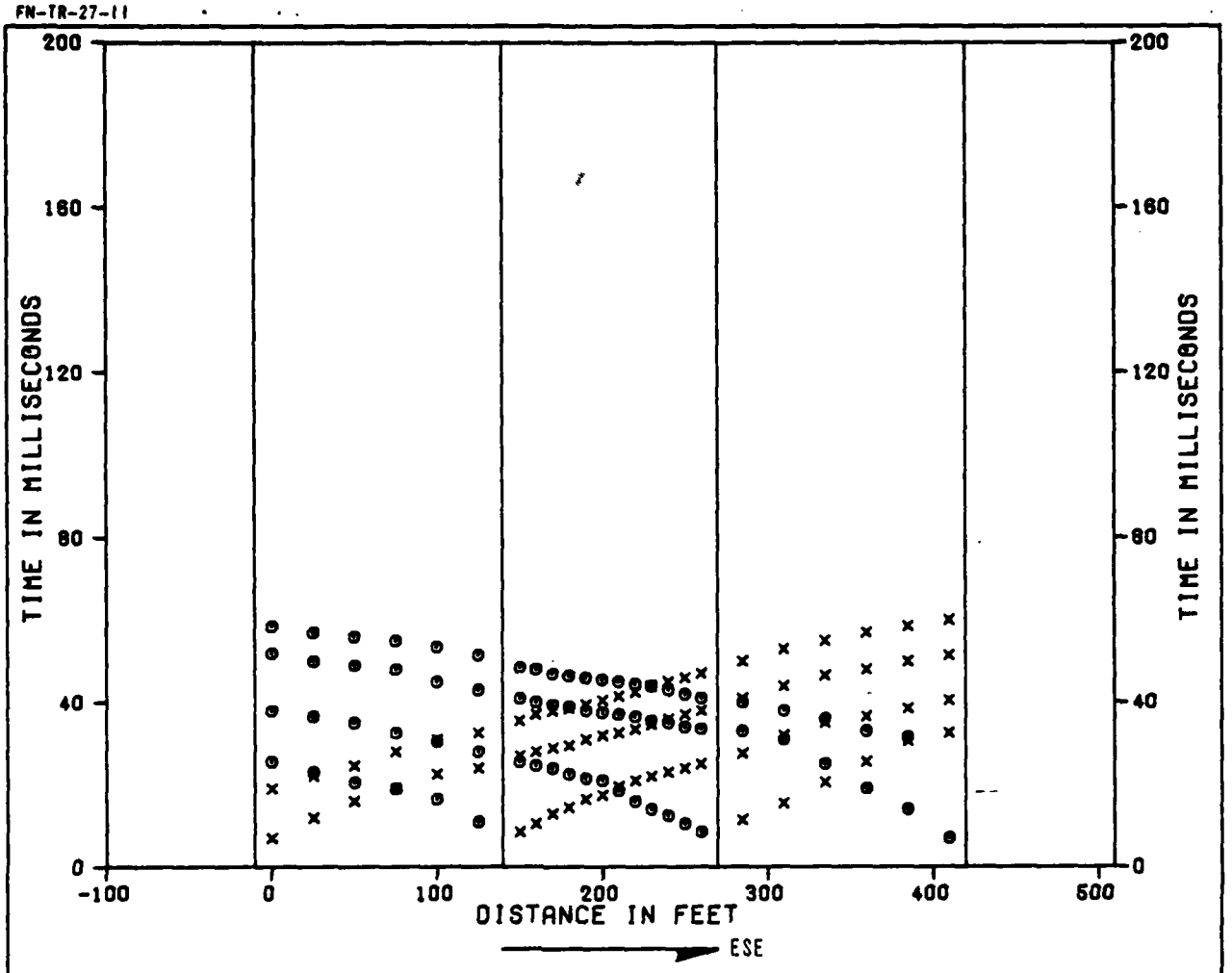
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

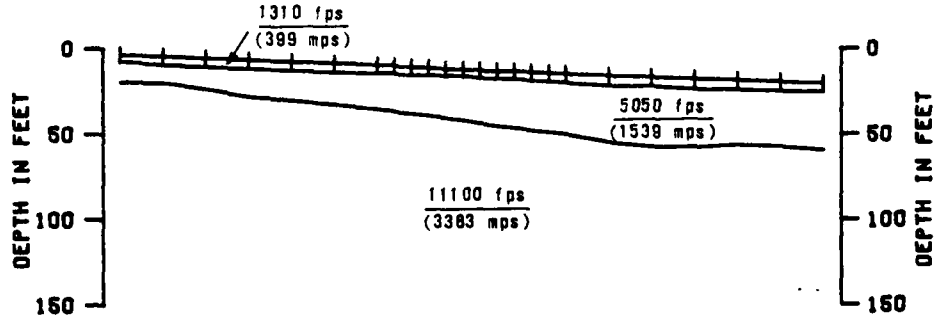
FIGURE 3-19

FUGRO NATIONAL, INC.

2 JUL 79

FN-TR-27-11





0 METERS 50

DISTANCE AND DEPTH

× TIMES TO RIGHT OF SHOTS

⊙ TIMES TO LEFT OF SHOTS

SEISMIC REFRACTION LINE WW-S-20
TIME DISTANCE DATA AND VELOCITY PROFILE
VERIFIACTION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 3-20

UGRO NATIONAL, INC.

2 JUL 79

SECTION 4.0

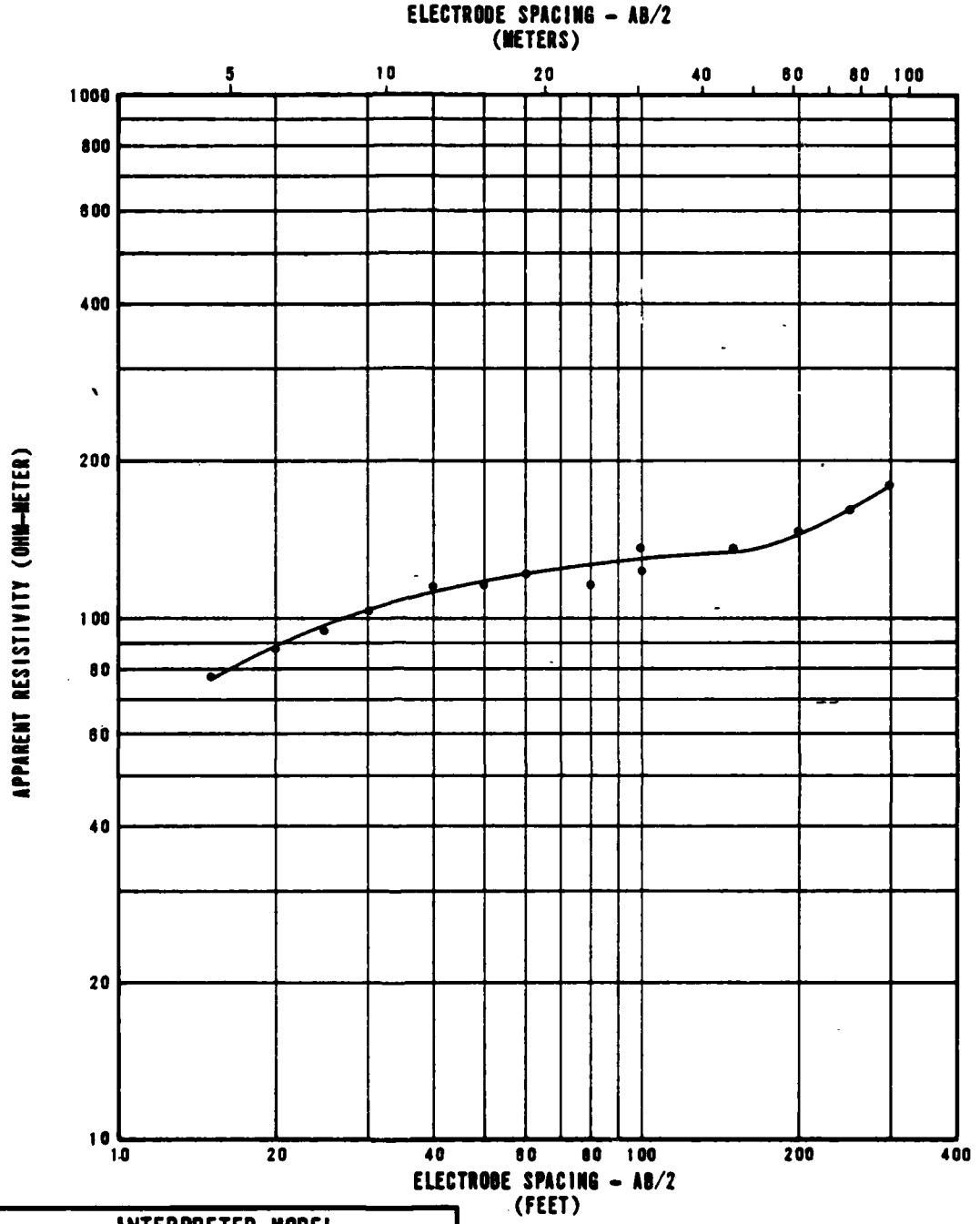
ELECTRICAL RESISTIVITY DATA

EXPLANATIONS OF ELECTRICAL RESISTIVITY DATA

Each figure in this section presents the data obtained from a resistivity sounding and a tabulated model of resistivity layers that would produce a curve similar to the observed curve.

The upper portion of the figures is a graph in which measured apparent resistivity values in ohm-meters are plotted versus one-half the distance between the current electrodes.

The interpreted model tabulated at the bottom of the page shows a combination of true resistivity layers and thicknesses obtained by matching theoretical curves to the field curve.



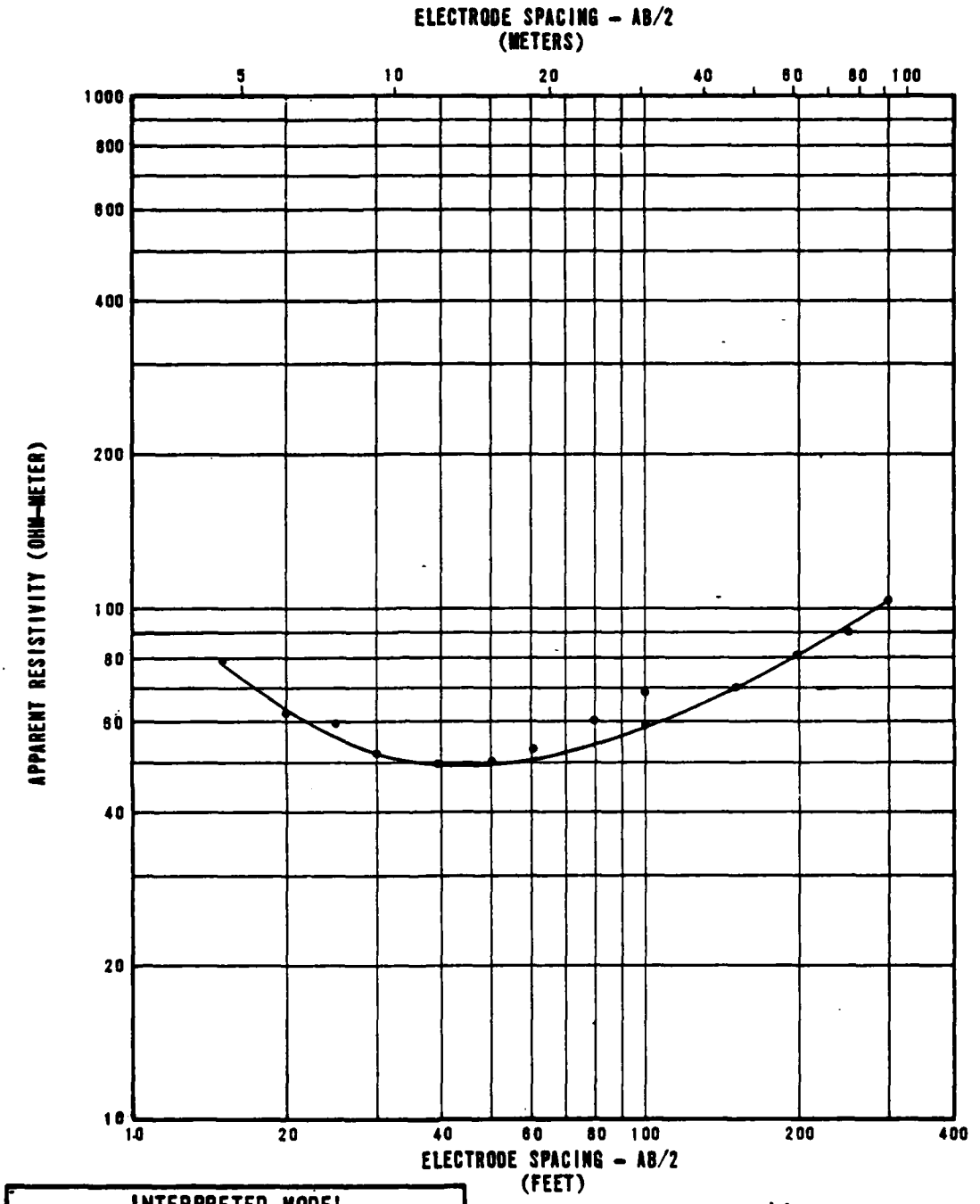
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	65
8	2	140
52	16	100
125	38	220
202	62	1130

RESISTIVITY SOUNDING WW-R-1
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
4-1

FUGRO NATIONAL, INC.



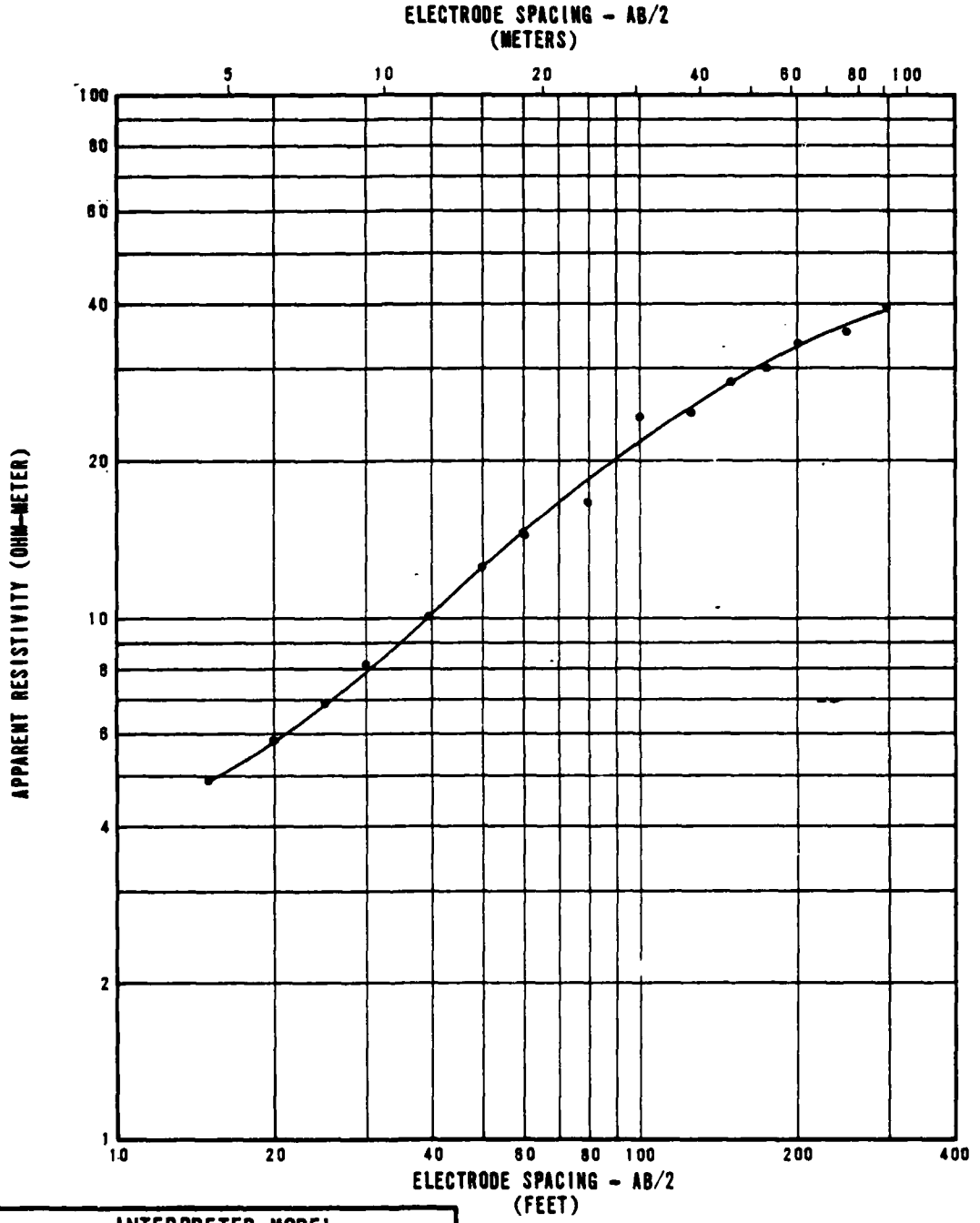
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	120
6	2	50
101	31	280

RESISTIVITY SOUNDING WW-R-2
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 4-2

UGRO NATIONAL, INC.



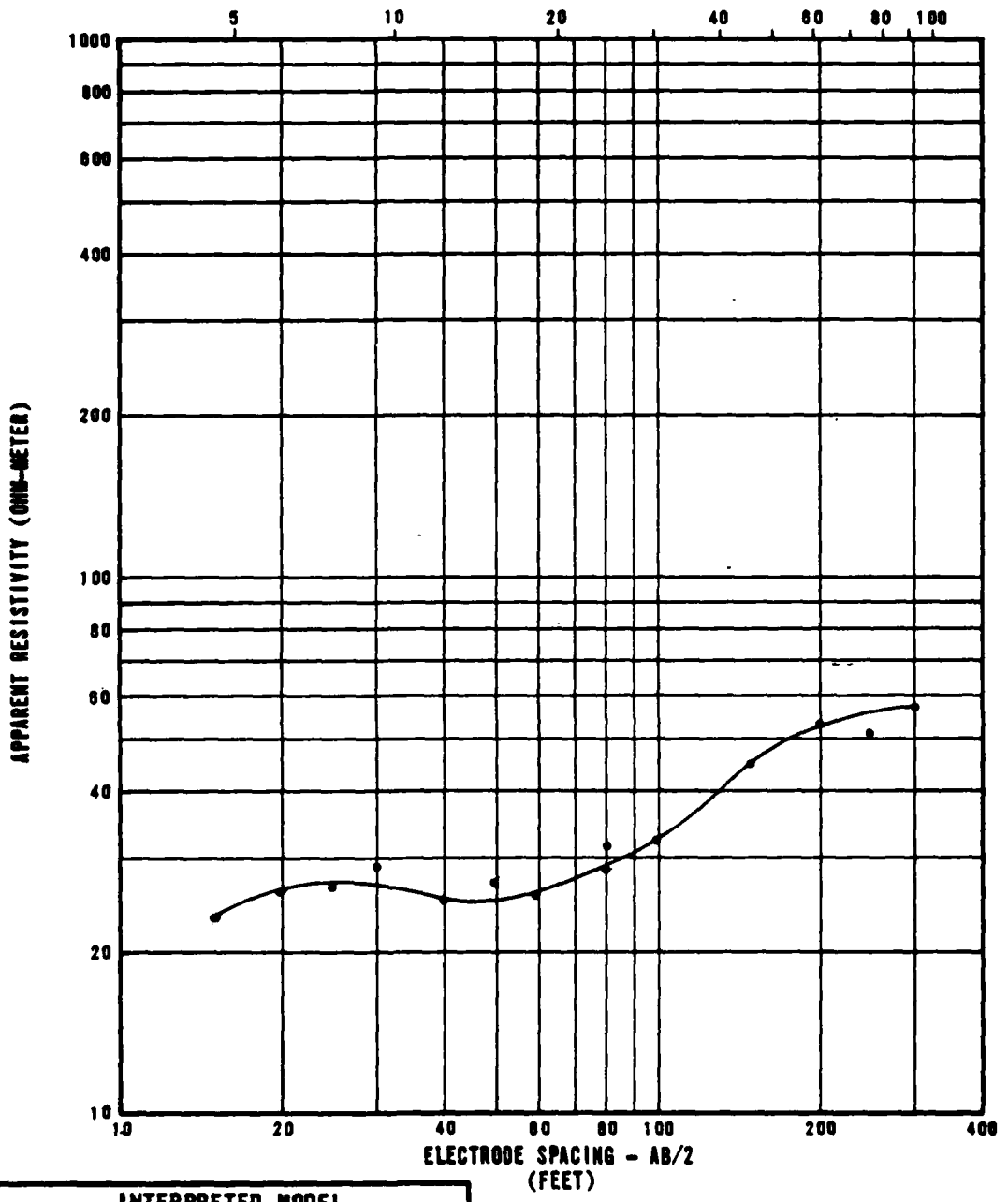
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	4
11	3	16
24	7	270
29	9	55

RESISTIVITY SOUNDING WW-R-3
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
4-3

FUGRO NATIONAL, INC.



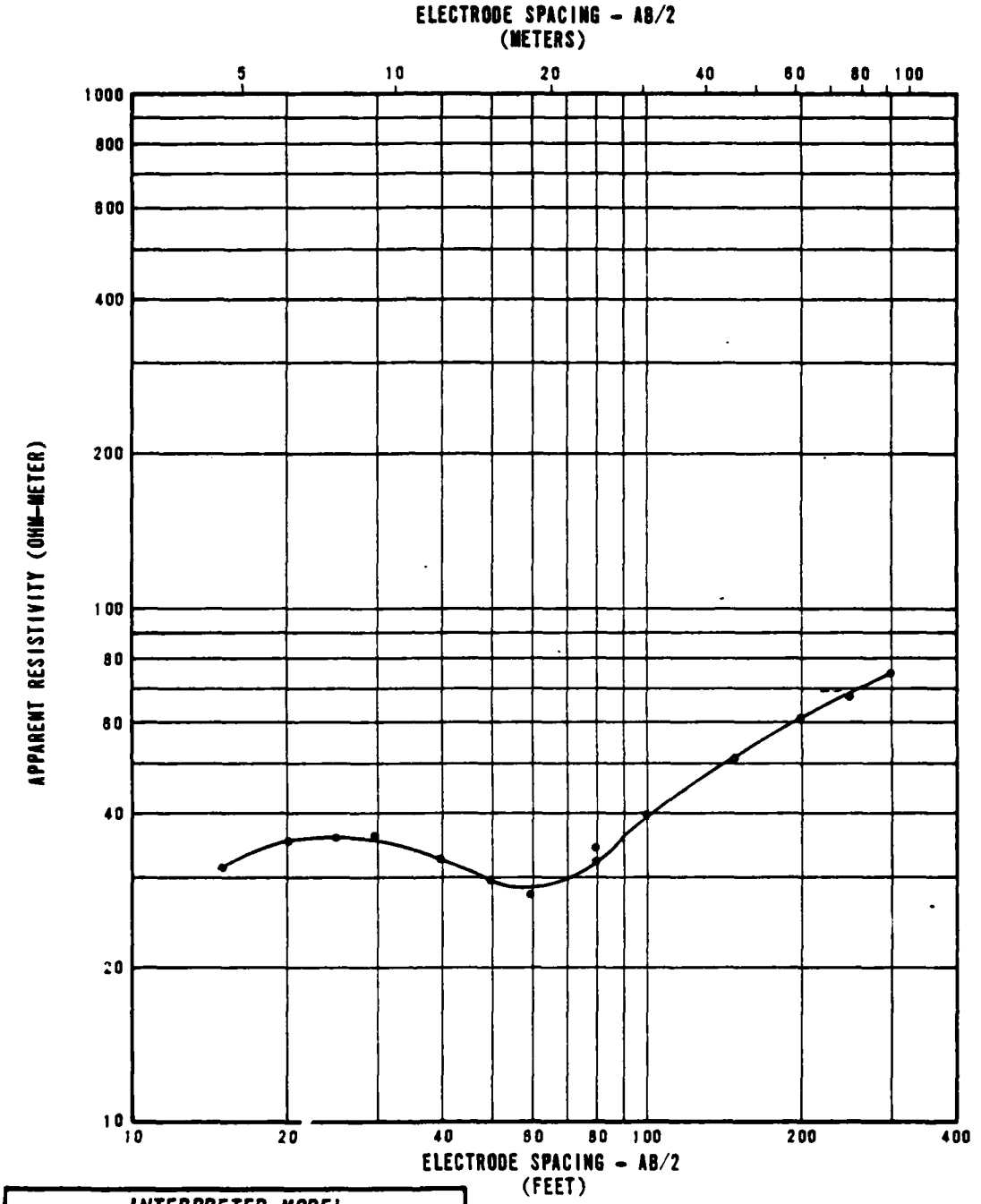
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	25
4	1	40
17	5	20
27	8	120
65	20	75

RESISTIVITY SOUNDING WW-R-4
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
4-4

WOODWARD-CLYDE CONSULTANTS



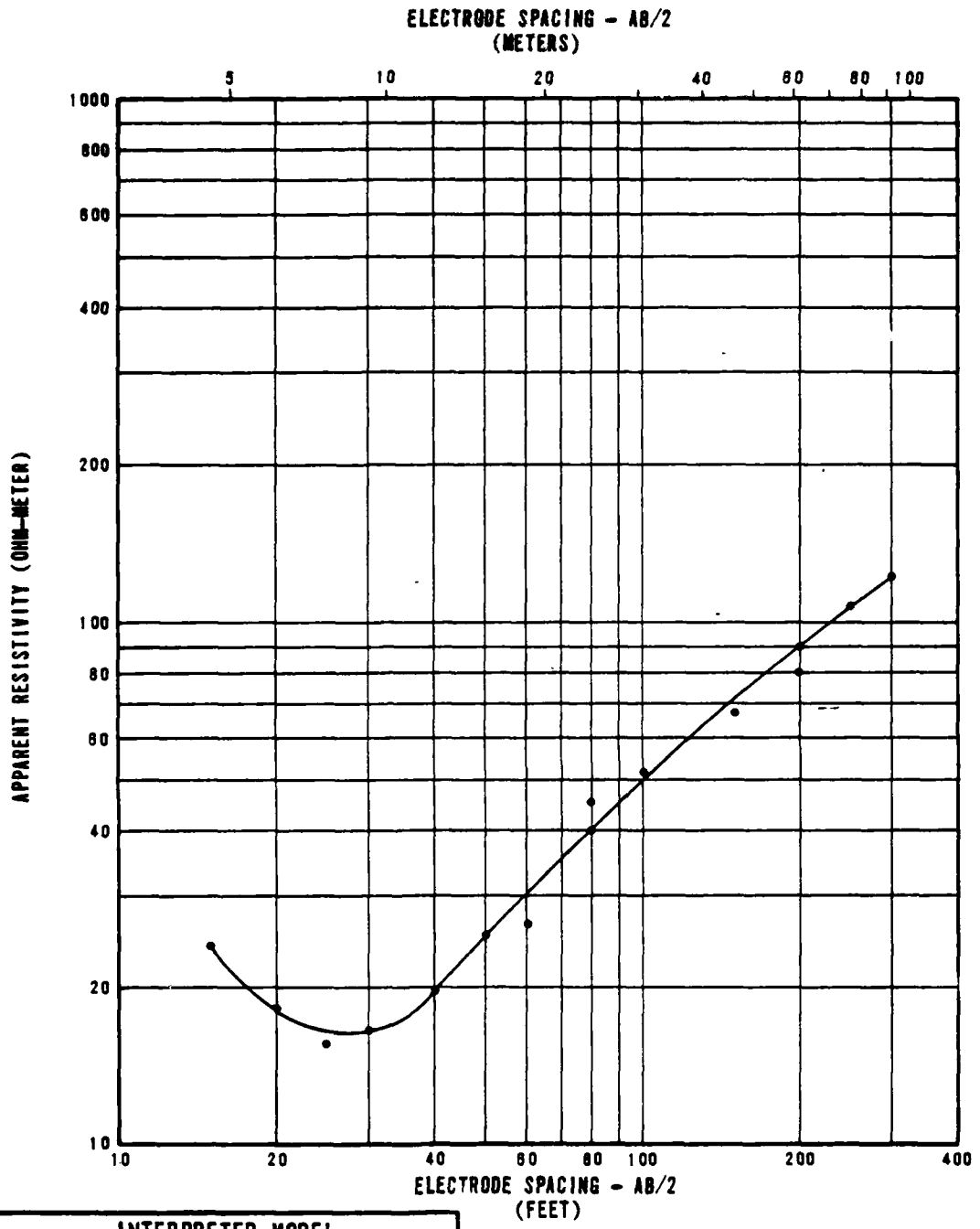
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	25
5	1	45
18	5	16
48	14	150
103	31	120

RESISTIVITY SOUNDING WW-R-5
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
4-5

FUGRO NATIONAL, INC.



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	25
11	3	18
38	12	110
45	14	280

RESISTIVITY SOUNDING WW-R-6
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 4-6

FUGRO NATIONAL, INC.

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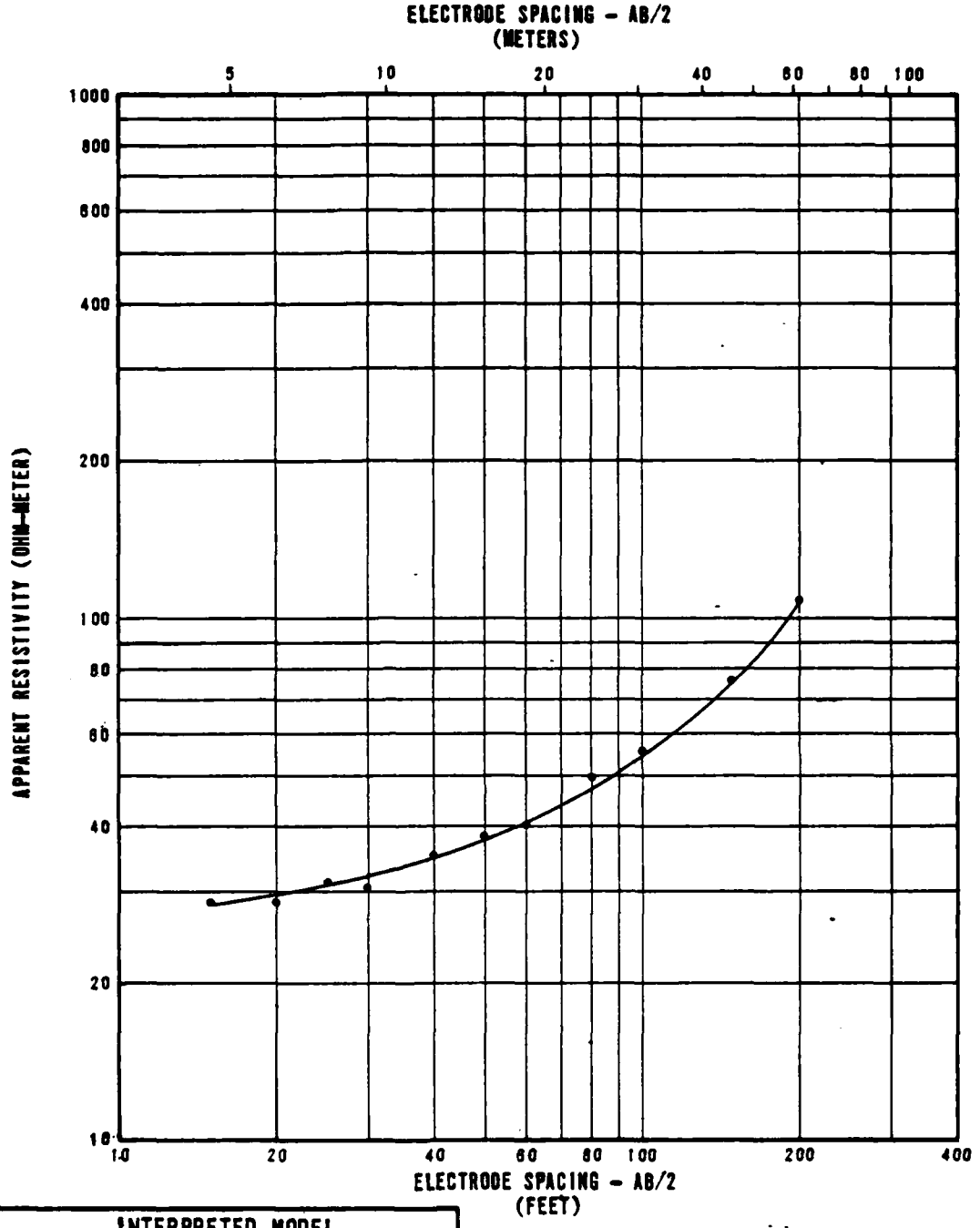
AFV-15



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	30
27	8	75
104	32	2910

RESISTIVITY SOUNDING WW-R-7
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

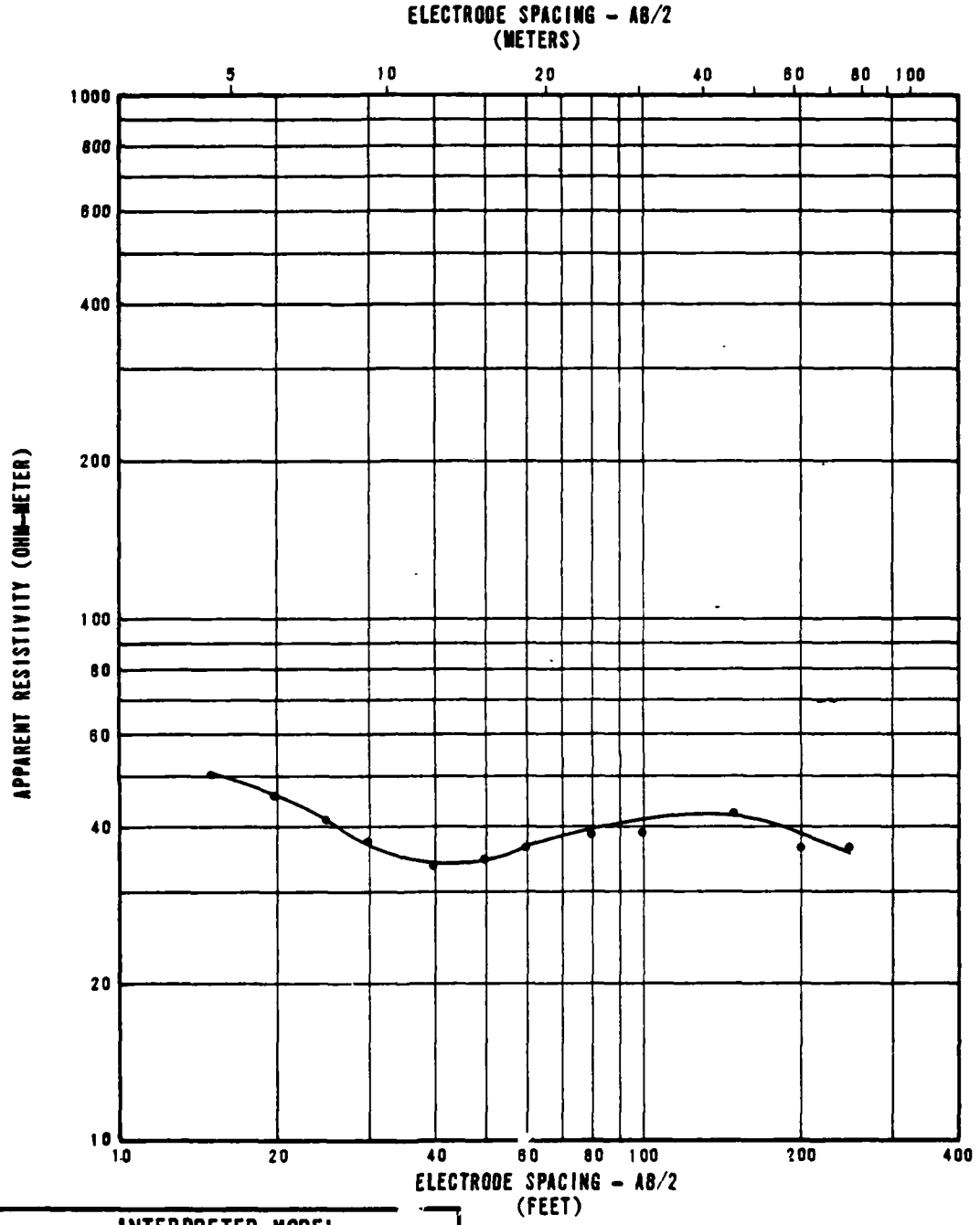
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 4-7

FUGRO NATIONAL, INC.

2 JUL 79

AFV-15



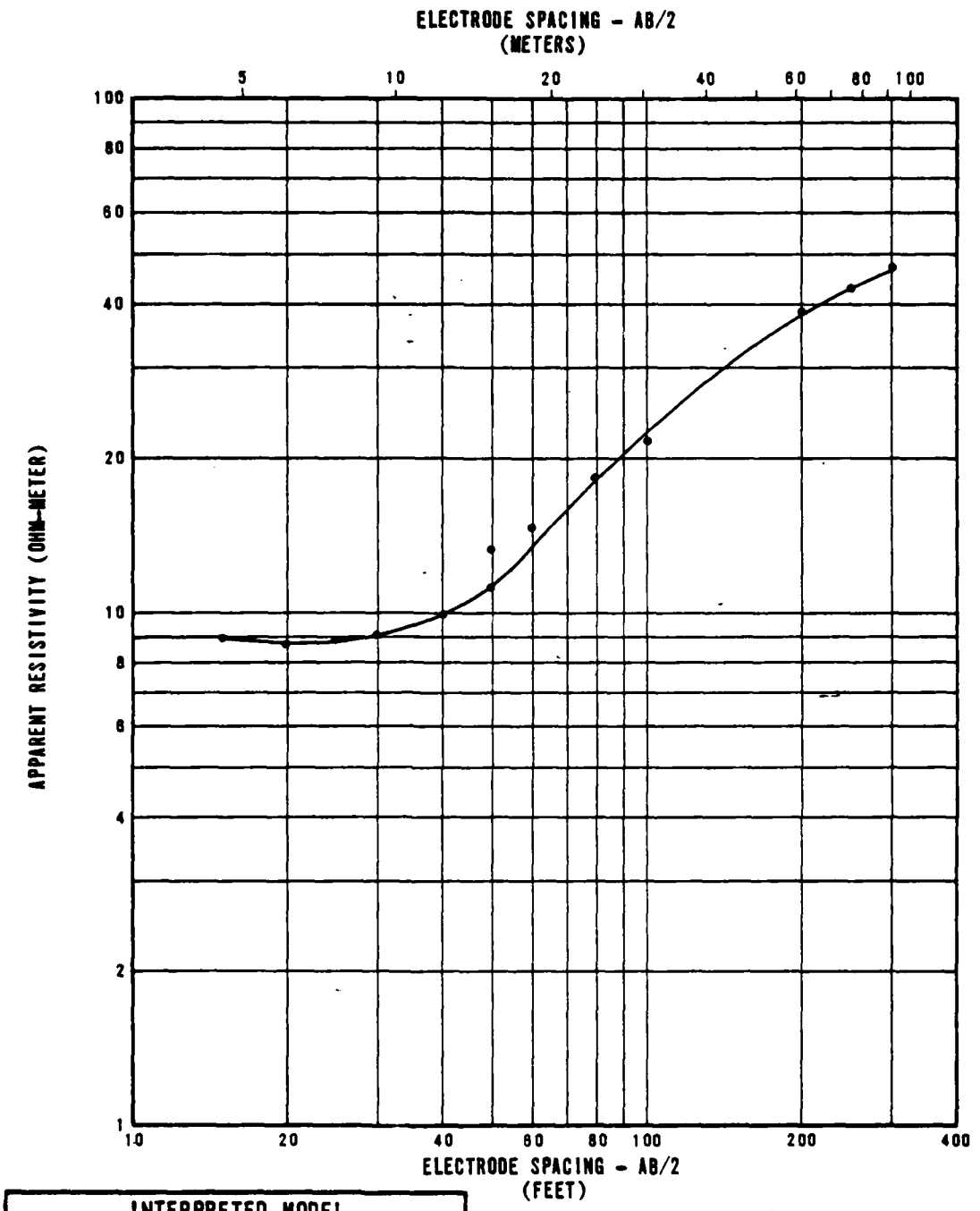
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	60
11	3	25
33	10	70
99	30	19

RESISTIVITY SOUNDING WW-R-8
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 4-8

FUGRO NATIONAL, INC.



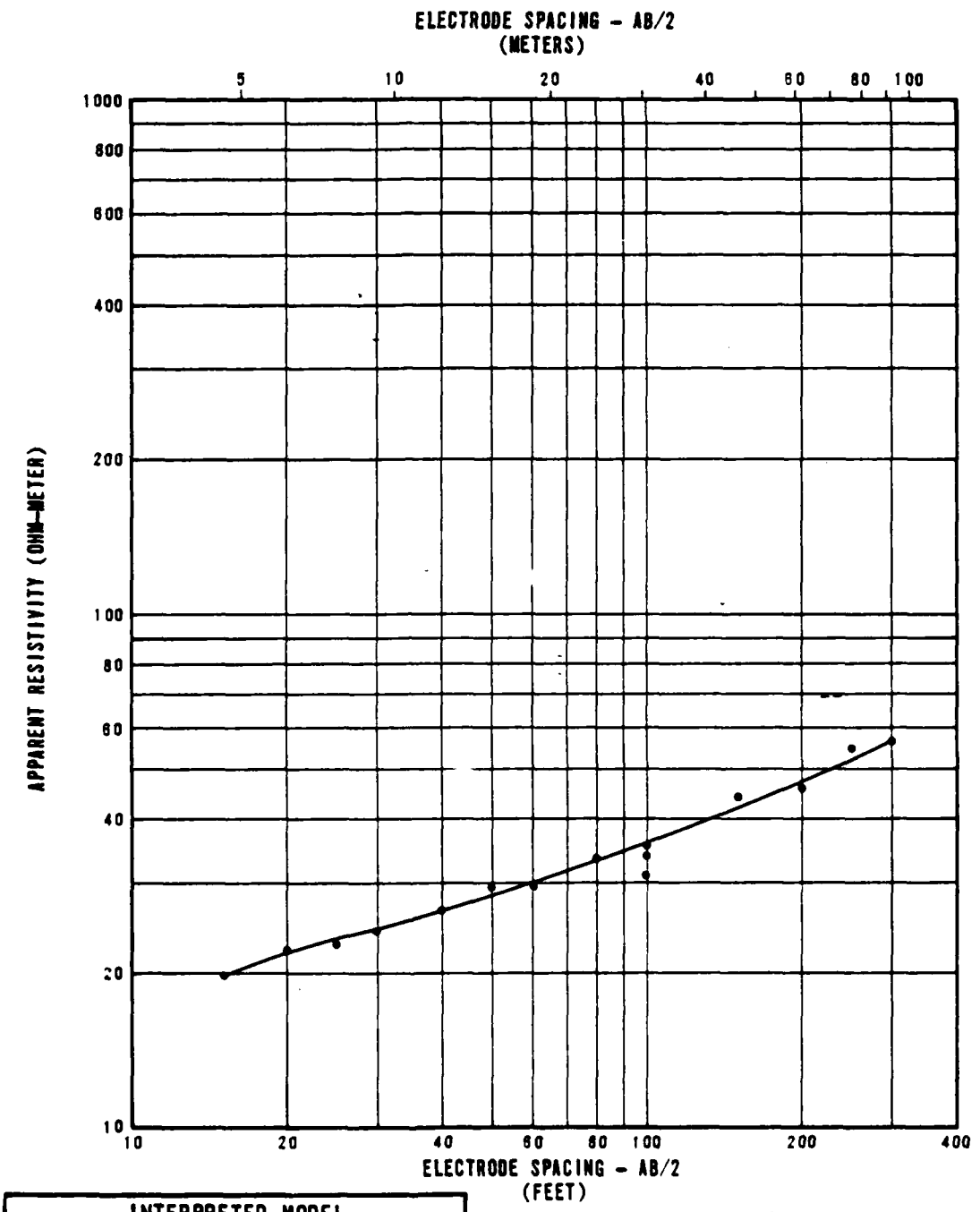
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	9
14	4	6
26	8	30
61	19	120

RESISTIVITY SOUNDING WW-R-9
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
4-9

FUGRO NATIONAL, INC.



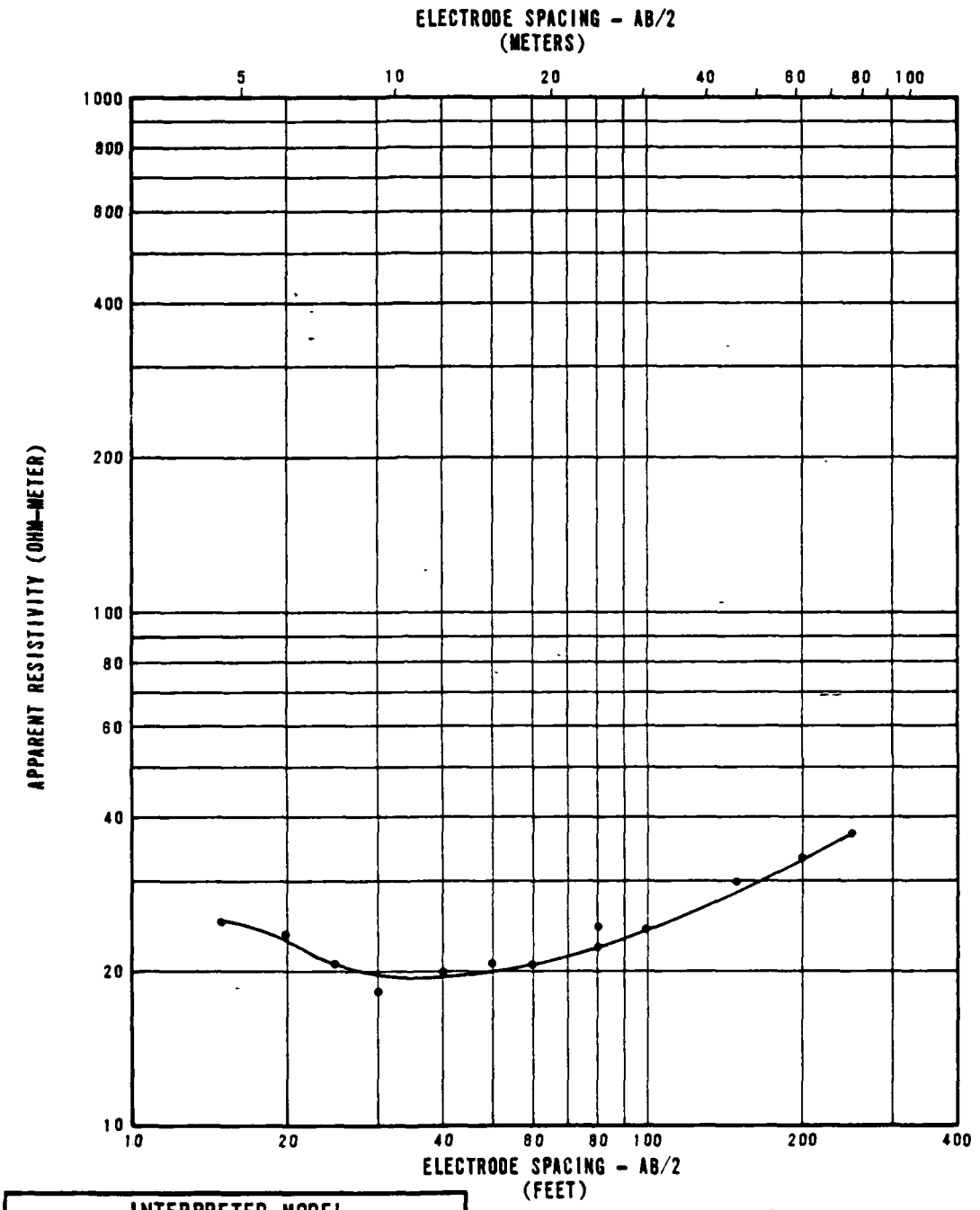
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	18
14	4	40
99	30	85

RESISTIVITY SOUNDING WW-R-10
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
4-10

FUGRO NATIONAL, INC.



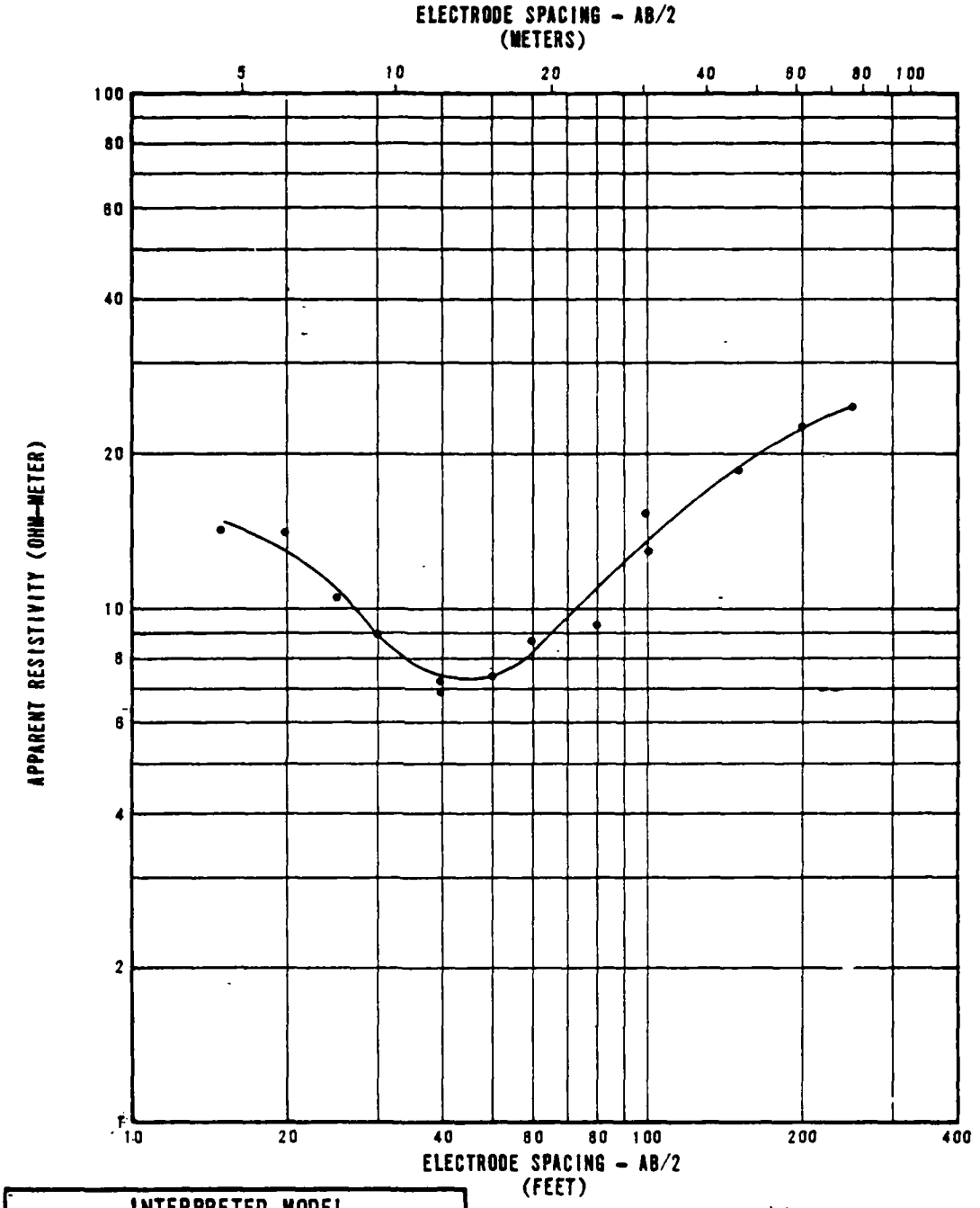
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	30
8	2	16
39	12	30
100	30	60

RESISTIVITY SOUNDING WW-R-11
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
4-11

FUGRO NATIONAL, INC.



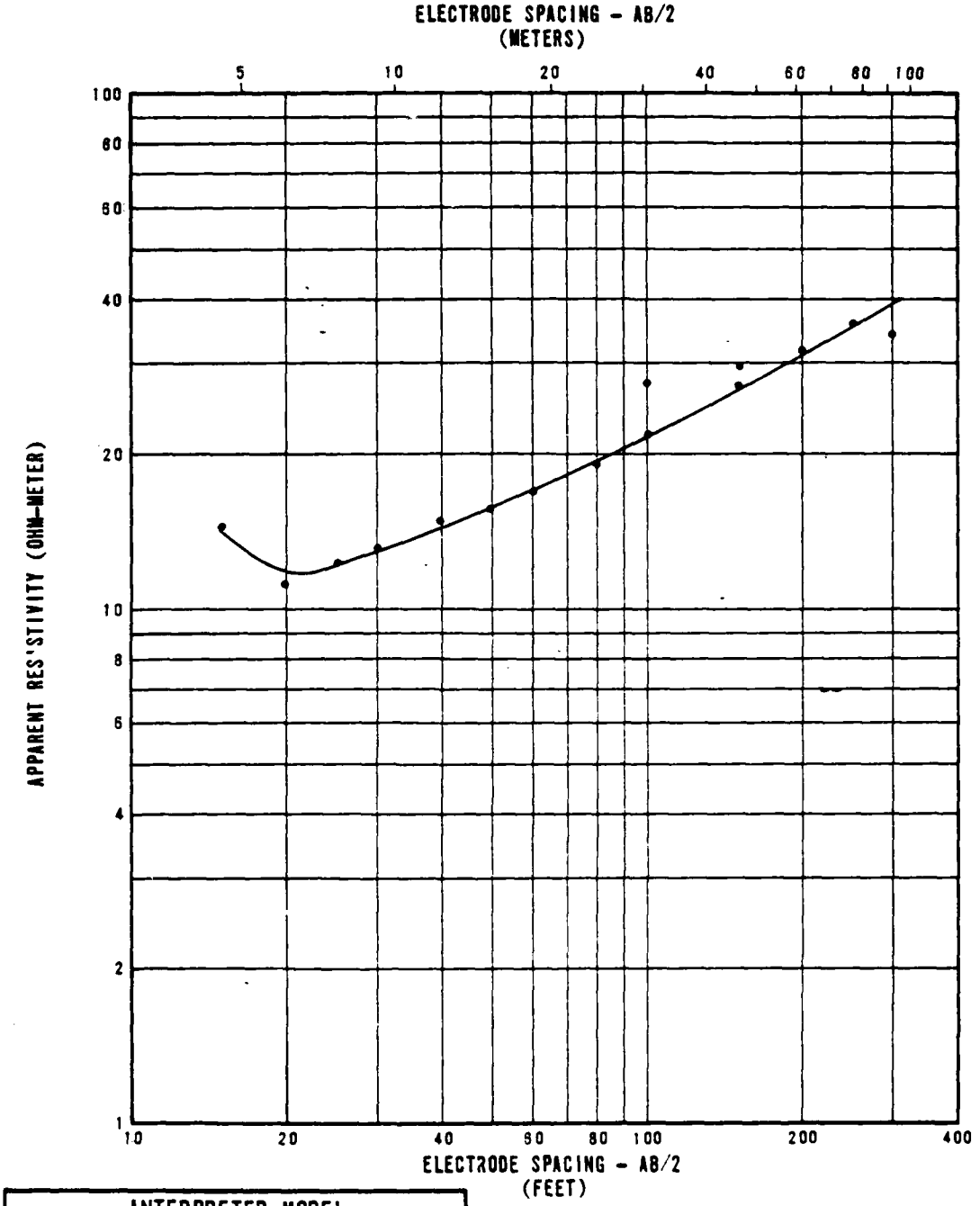
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	20
10	3	4
23	7	50
97	30	40

RESISTIVITY SOUNDING WW-R-12
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
4-12

FUGRO NATIONAL, INC.



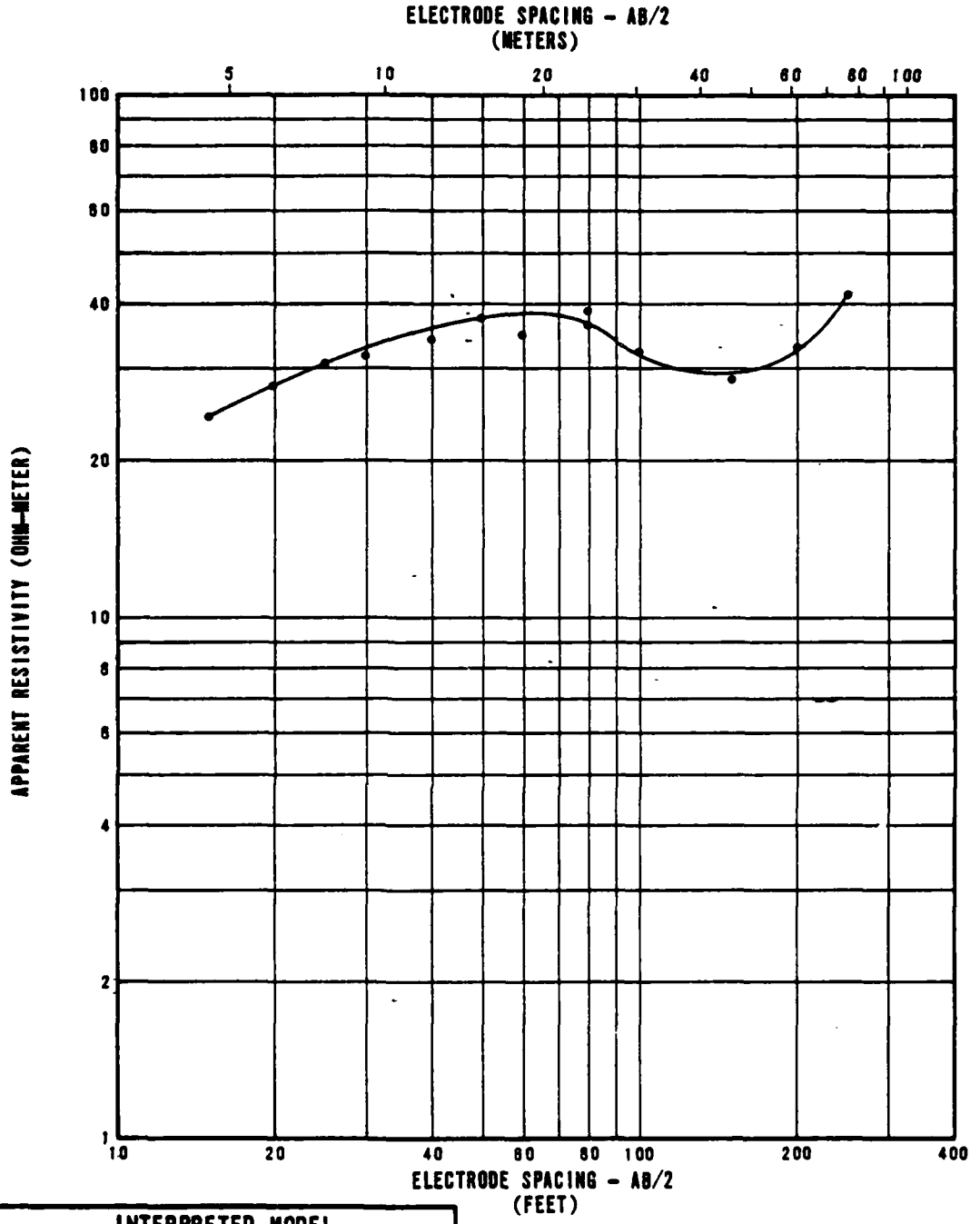
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	20
6	2	9
23	7	25
52	16	55

RESISTIVITY SOUNDING WW-R-13
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
4-13

FUGRO NATIONAL, INC.



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	18
7	2	50
41	12	17
147	45	800

RESISTIVITY SOUNDING WW-R-14
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

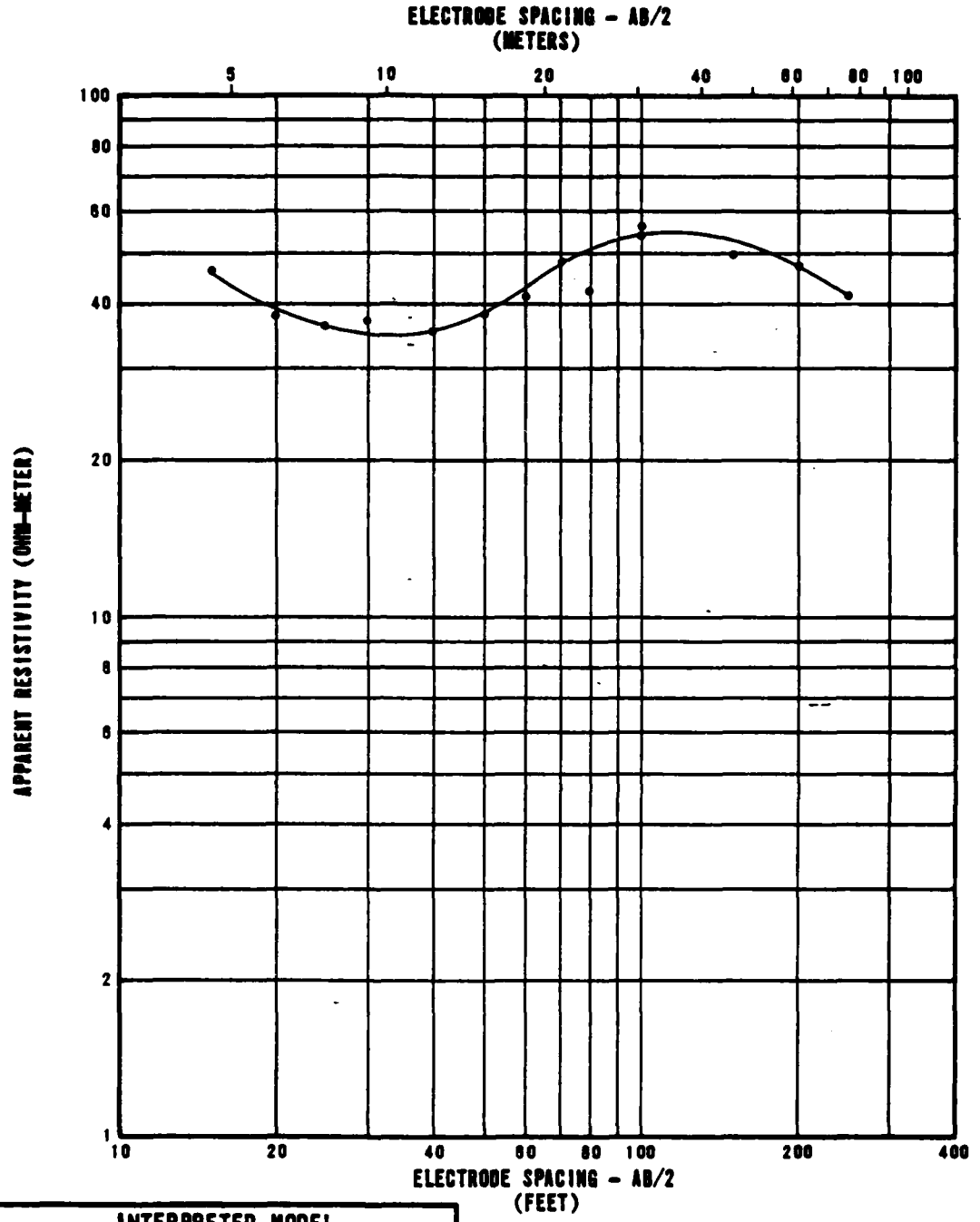
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
4-14

FUGRO NATIONAL, INC.

2 JUL 79

AFV-15



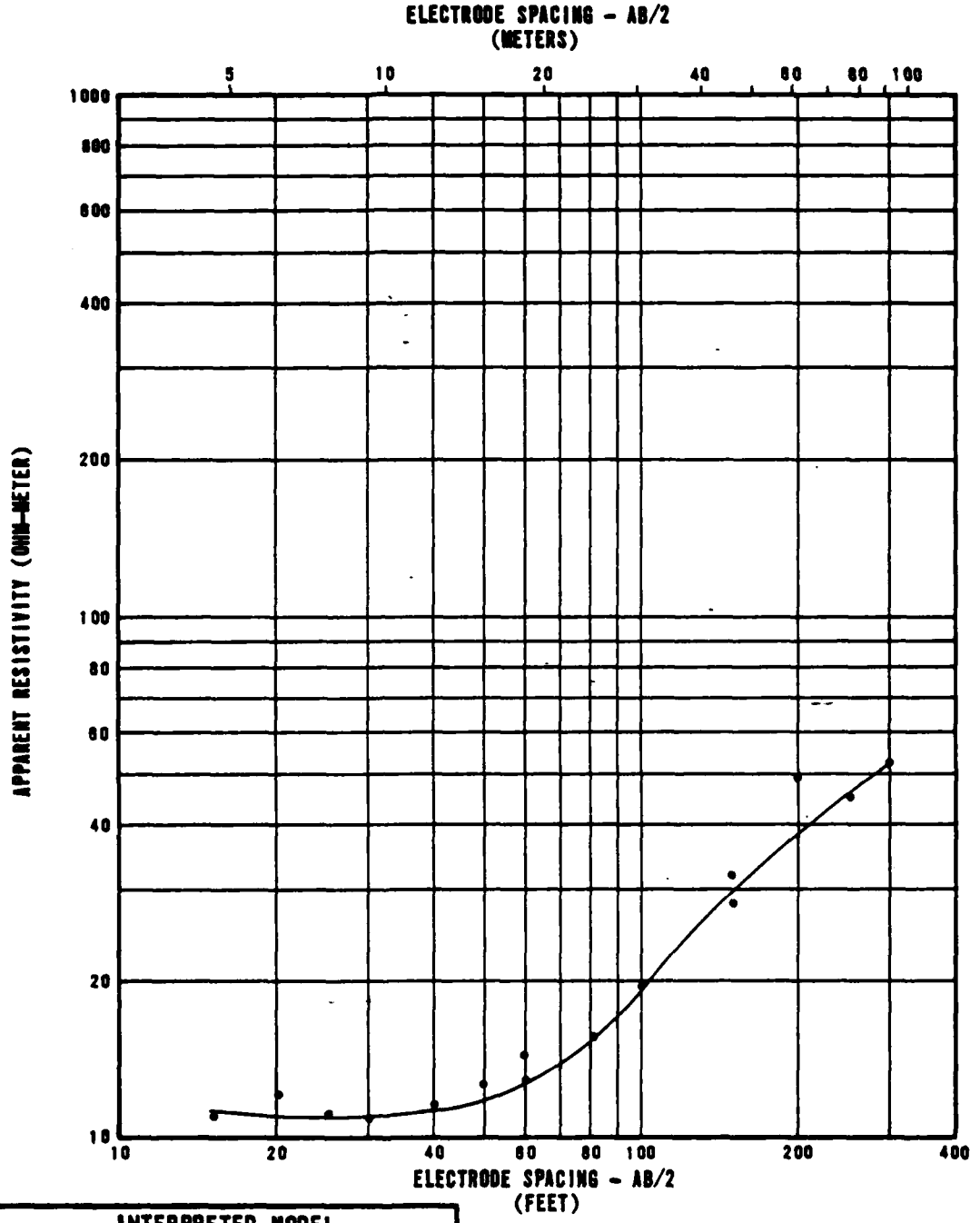
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	70
5	2	30
38	12	95
74	23	19

RESISTIVITY SOUNDING WW-R-15
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND COR, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
4-15

FUGRO NATIONAL, INC.



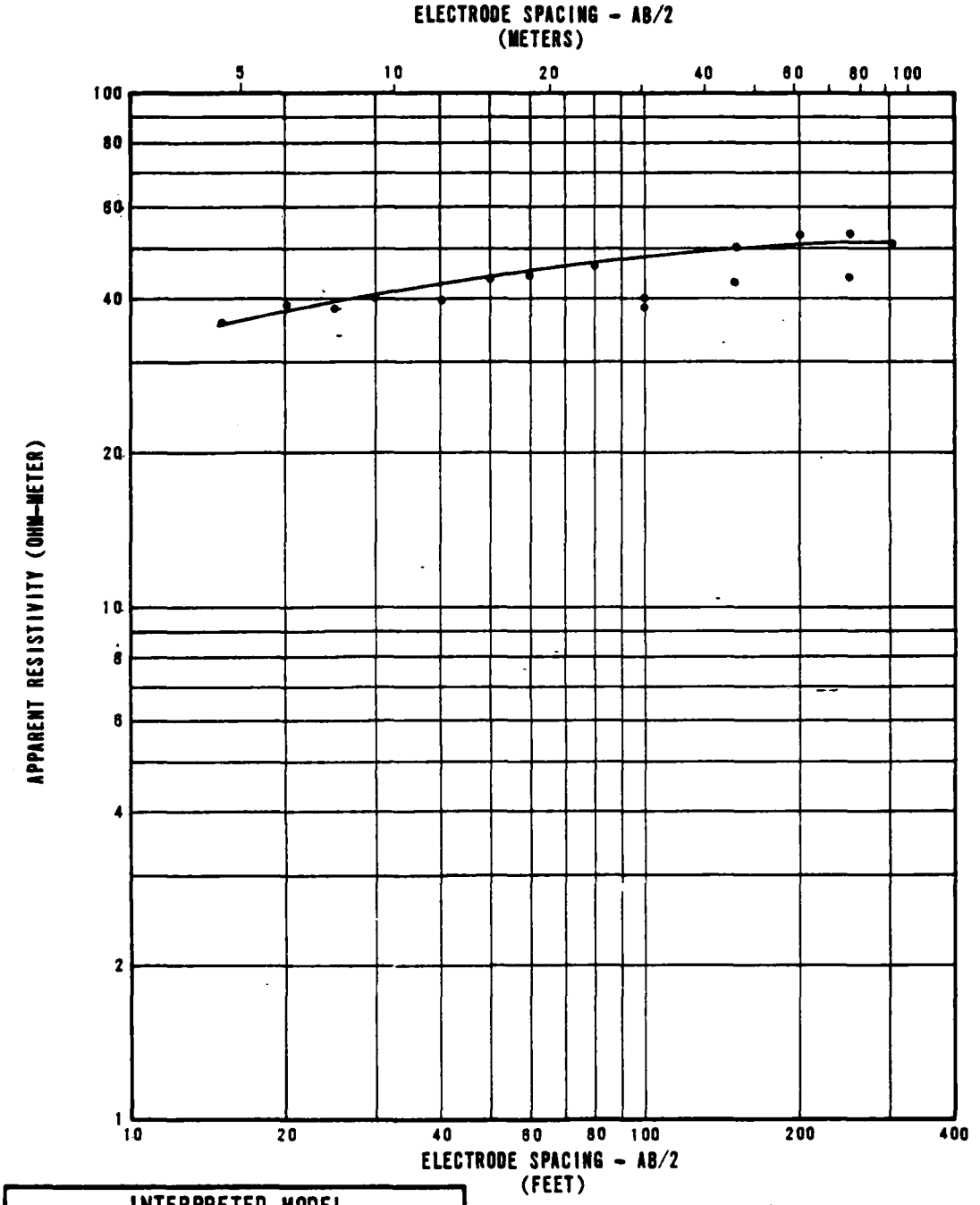
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	10
50	15	70
67	20	210

RESISTIVITY SOUNDING WW-R-16
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
4-16

FUGRO NATIONAL, INC.



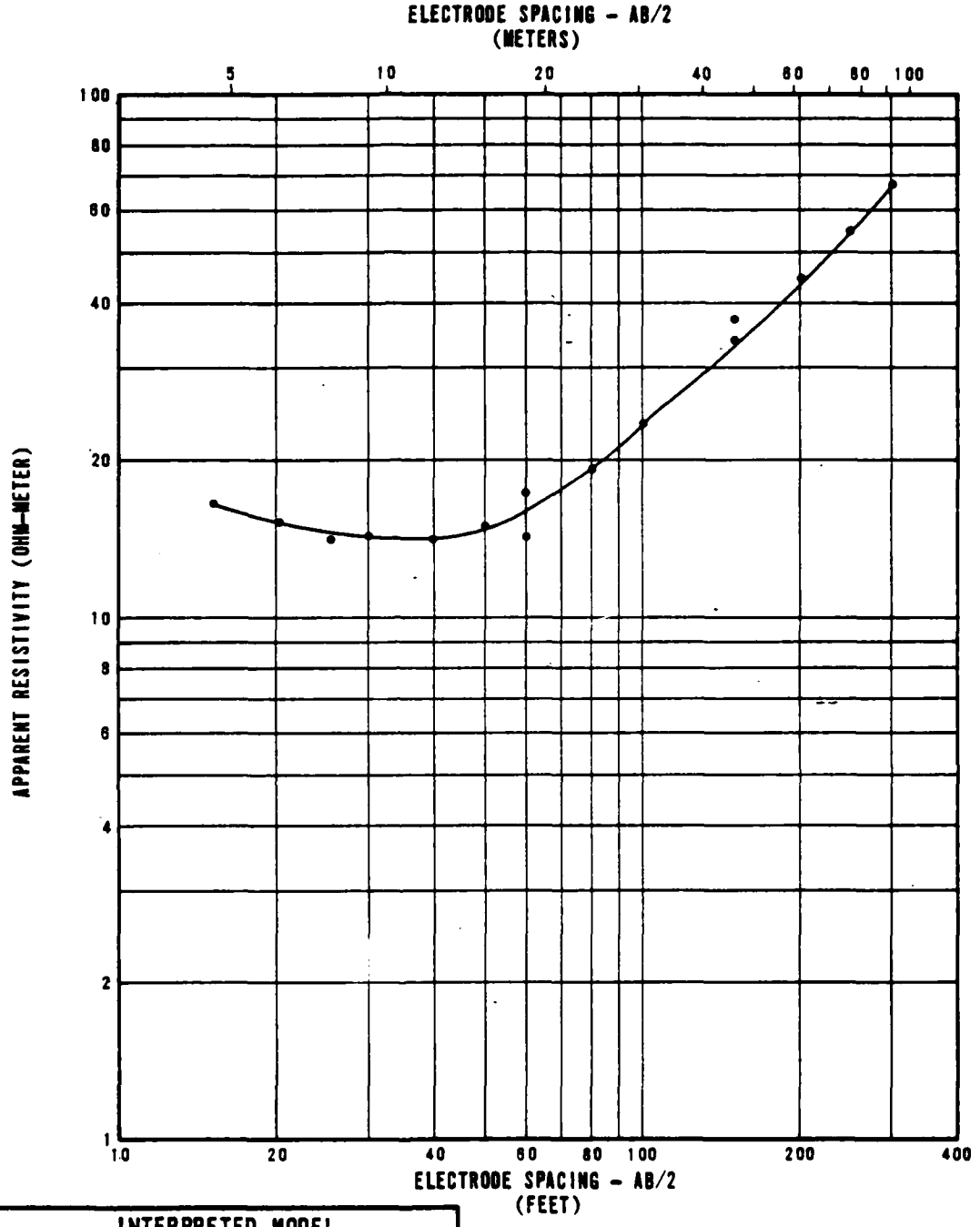
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	35
18	6	55

RESISTIVITY SOUNDING WW-R-17
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
4-17

FUGRO NATIONAL, INC.



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	18
11	3	11
48	15	95
85	26	310
103	31	2030

RESISTIVITY SOUNDING WW-R-18
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

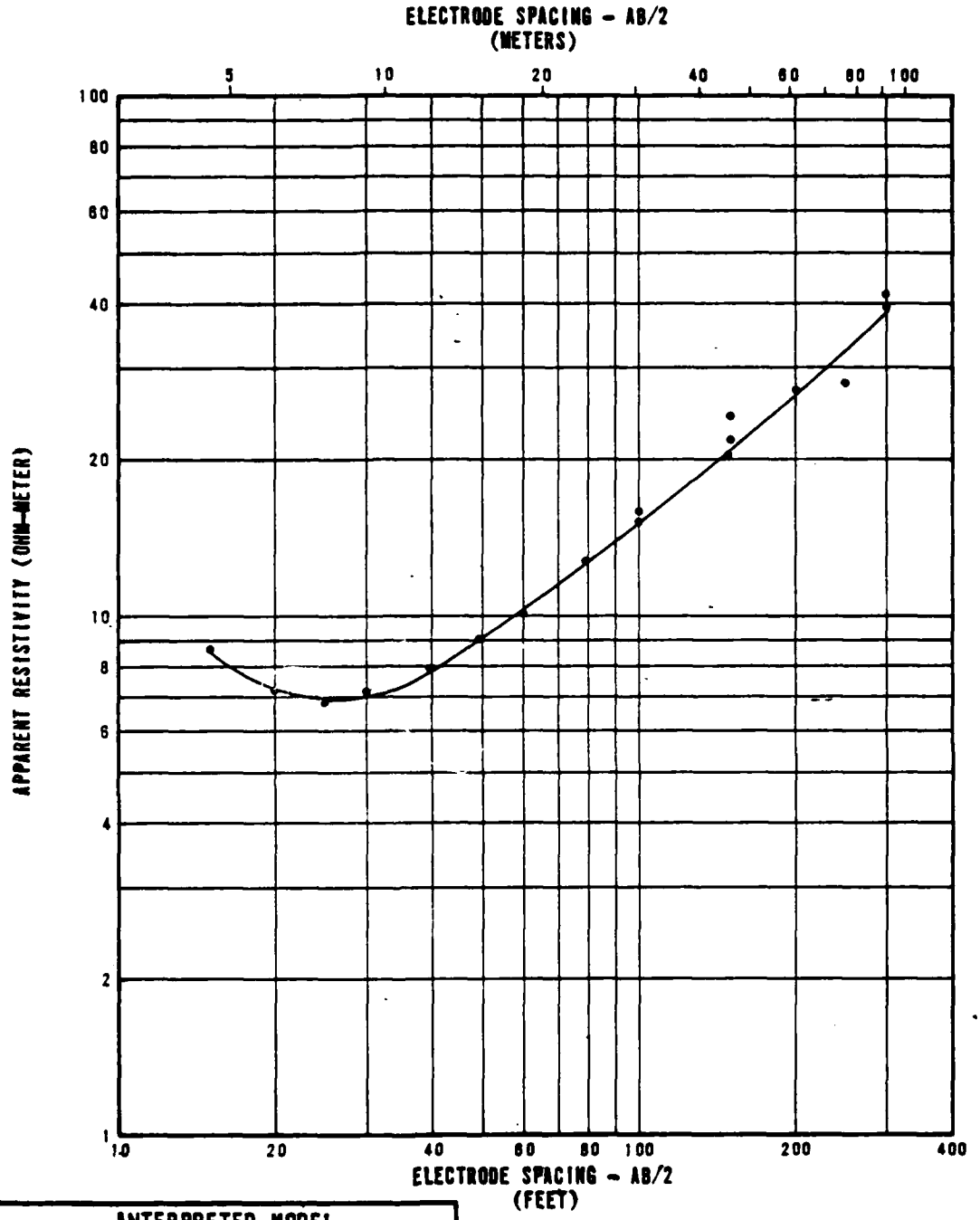
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 4-18

UGRO NATIONAL, INC.

2 JUL 79

AFV-15



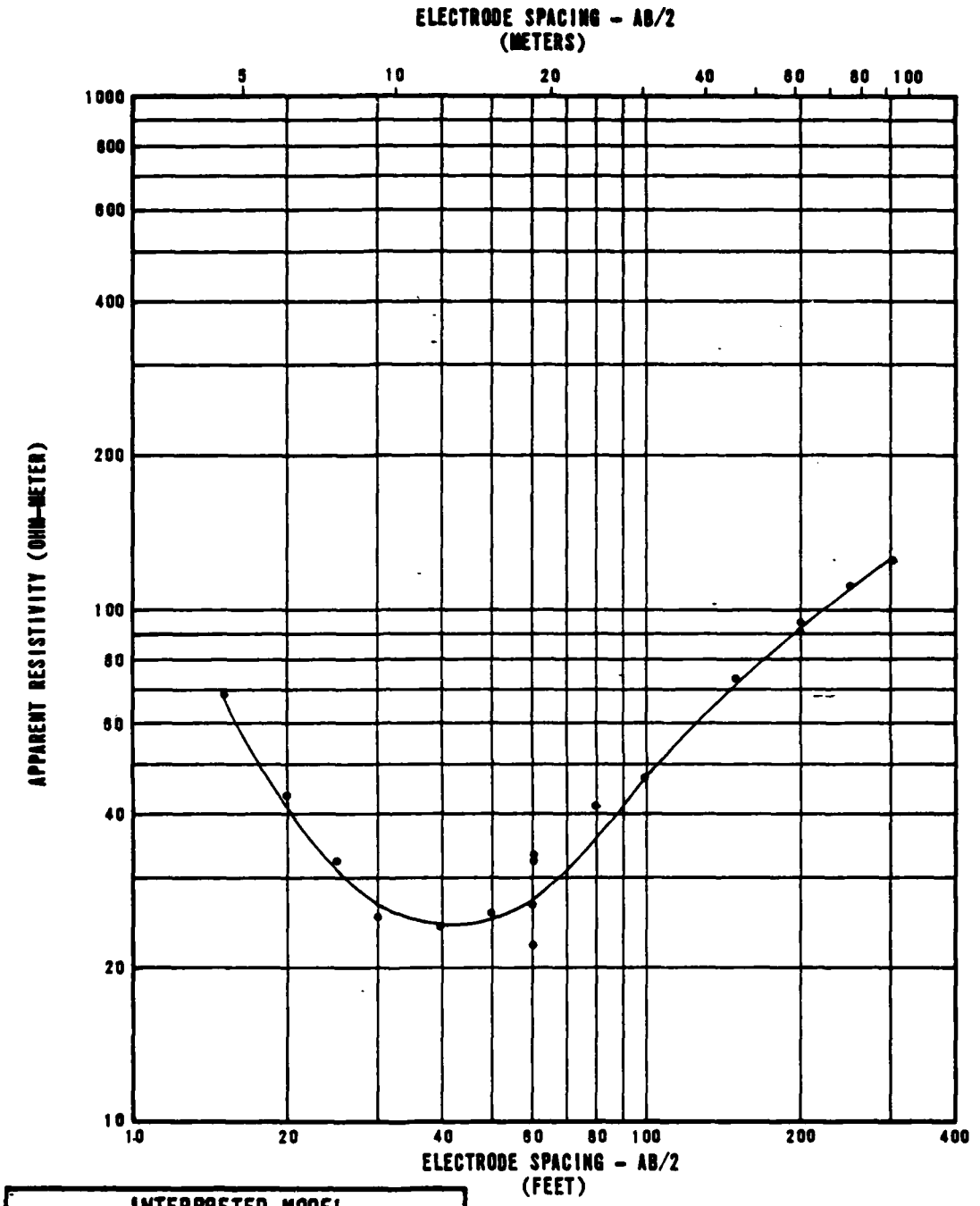
INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	13
6	2	6
28	9	19
83	25	90
118	36	1060

RESISTIVITY SOUNDING WW-R-19
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
4-19

FUGRO NATIONAL, INC.



INTERPRETED MODEL		
LAYER DEPTH		RESISTIVITY VALUES
FEET	METERS	OHM-METER
0	0	70
11	3	16
38	12	300

RESISTIVITY SOUNDING WW-R-20
SOUNDING CURVE AND INTERPRETATION
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 4-20

FUGRO NATIONAL, INC.

2 JUL 79

AFV-15

SECTION 5.0

GRAVITY DATA

EXPLANATIONS OF GRAVITY DATA

Gravity data were not available in time (prior to June 1979) for incorporation into this report. A supplemental report containing gravity data and results will be issued at a later date.

SECTION 6.0

BORING LOGS

EXPLANATIONS OF BORING, TRENCH, AND TEST PIT LOGS

All data from borings, trenches, and test pits are presented on standard Fugro National logs in Sections 6.0 and 7.0. The following explanations are provided as a key to the logs.

A. Designations - Borings, trenches, and test pits are identified as follows:

WW-B-1
WW - abbreviation for the site (e.g., WW-Whirlwind)
B - abbreviation for activity (e.g., B-boring, T-trench, P-test pit)
1 - number of activity

B. Sample Type - Different sampling techniques were used and the symbols are explained at the bottom of the boring logs. For details of sampling techniques, see Section A5.0 of Appendix in Volume I. Horizontal lines, to scale, indicate the depth where sampling was attempted.

C. Percent Recovery - The numbers shown represent the ratio (in percent) of the soil sample recovered in the sampler to the full penetration of the sampler.

D. N Value - Corresponds to standard penetration resistance, which is number of blows required to drive a standard split-spoon sampler for the second and third of three 6-inch (15 cm) increments with a 140-pound (63.5 kg) hammer falling 30 inches (76 cm) (ASTM D 1586-67).

E. Depth - Corresponds to depth below ground surface in meters and feet.

F. Lithology - Graphic representation of the soil and rock types.

G. USCS - Unified Soil Classification System (see Table 6-1 for complete details) symbols.

H. Soil Description - Except in cases where samples were classified based on laboratory test data, the descriptions are based on visual classification. The procedures outlined in ASTM D 2487-69, Classification of Soils for Engineering Purposes, and D 2488-69, Description of Soils (Visual-Manual Procedure) were followed. Solid lines across the column indicate known change in strata at the depth shown.

Definitions of some of the terms and criteria to describe soils and conditions encountered during the exploration follow.

Gradation : A coarse-grained soil is well graded if it has a wide range in grain size and substantial amounts of most intermediate particle sizes.

Poorly graded indicates that the soil consists predominantly of one size (uniformly graded) or has a wide range of sizes with some intermediate sizes obviously missing (gap-graded).

Moisture :

Dry	- no feel of moisture
Slightly Moist	- much less than normal moisture
Moist	- normal moisture for soil
Very Moist	- much greater than normal moisture
Wet	- for soils below the water table (if known)

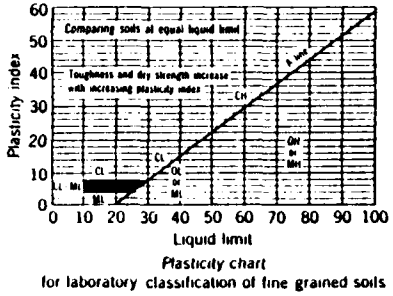
UNIFIED SOIL CLASSIFICATION SYSTEM

TABLE 6-1

WX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TUBRO NATIONAL, INC.

Field Identification Procedures (Excluding particles larger than 3 in. and basing fractions on estimated weights)						Group Symbols [a]	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria
Coarse-grained soils: More than half of material is larger than No. 200 sieve size [b] (The No. 200 sieve size is about the smallest particle visible to the naked eye)	Gravels: More than half of coarse fraction is larger than No. 4 sieve size (For visual classification, the ¼ in. size may be used as equivalent to the No. 4 sieve size)	Clean gravels (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes			GW	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name; indicate approximate percentages of sand and gravel; maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbols in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics Example: *Silty sand*, gravelly; about 20%, hard, angular gravel particles ½-in maximum size; rounded and subangular sand grains coarse to fine, about 15%, nonplastic fines with low dry strength; well compacted and moist in place, alluvial sand, (SM)	$C_U = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			Predominantly one size or a range of sizes with some intermediate sizes missing			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW
		Gravels with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see ML below)			GM	Silty gravels, poorly graded gravel-sand-silt mixtures		Atterberg limits below "A" line, or PI less than 4 / Above "A" line with PI between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see CL below)			GC	Clayey gravels, poorly graded gravel-sand-clay mixtures		Atterberg limits above "A" line, with PI greater than 7
	Sands: More than half of coarse fraction is smaller than No. 4 sieve size (For visual classification, the ¼ in. size may be used as equivalent to the No. 4 sieve size)	Clean sands (little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes			SW	Well graded sands, gravelly sands, little or no fines		$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3
			Predominantly one size or a range of sizes with some intermediate sizes missing			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW
		Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures, see ML below)			SM	Silty sands, poorly graded sand-silt mixtures		Atterberg limits below "A" line or PI less than 5 / Above "A" line with PI between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see CL below)			SC	Clayey sands, poorly graded sand-clay mixtures		Atterberg limits below "A" line with PI greater than 7
Fine-grained soils: More than half of material is smaller than No. 200 sieve size (The No. 200 sieve size is about the smallest particle visible to the naked eye)	Identification Procedures on Fraction Smaller than No. 40 Sieve Size								
	Silts and clays: liquid limit less than 50		Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)				
			None to slight	Quick to slow	None	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	Give typical name; indicate degree and character of plasticity, amount and maximum size of coarse grains; colour in wet condition, odour if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on structure, stratification, consistency in undisturbed and remoulded states, moisture and drainage conditions Example: *Clayey silt*, brown; slightly plastic; small percentage of fine sand, numerous vertical root holes, firm and dry in place; loess, (ML)	Use grain size curve in identifying the fractions as given under field identification Determine percentages of gravel and sand from grain size curve Depending on percentage of fines (fraction smaller than No. 200 sieve size) coarse grained soils are classified as follows: Less than 5%: GW, GP, SW, SP More than 12%: GM, GC, SM, SC *Borderline* cases requiring use of dual symbols
			Medium to high	None to very slow	Medium	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			Slight to medium	Slow	Slight	OL	Organic silts and organic silt-clays of low plasticity		
	Silts and clays: liquid limit greater than 50		Slight to medium	Slow to none	Slight to medium	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			High to very high	None	High	CH	Inorganic clays of high plasticity, fat clays		
			Medium to high	None to very slow	Slight to medium	OH	Organic clays of medium to high plasticity		
Highly Organic Soils			Readily identified by colour, odour, spongy feel and frequently by fibrous texture			Pt	Peat and other highly organic soils		



Plasticity chart
for laboratory classification of fine grained soils

From Wagner, 1957.

[a] *Boundary classifications*: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example *GW GC*, well graded gravel-sand mixture with clay binder.

[b] All sieve sizes on this chart are U.S. standard.

Field Identification Procedure for Fine Grained Soils or Fractions

These procedures are to be performed on the minus No. 40 sieve size particles, approximately ¼₆₄ in. For field classification purposes, screening is not intended, simply remove by hand the coarse particles that interfere with the tests.

Dilatancy (Reaction to shaking):

After removing particles larger than No. 40 sieve size, prepare a pat of moist soil with a volume of about one-half cubic inch. Add enough water if necessary to make the soil soft but not sticky.

Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water on the surface of the pat which *changes to a livery consistency and becomes glossy*. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens and finally it cracks or crumbles. The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil.

Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, show a moderately quick reaction.

Dry Strength (Crushing characteristics):

After removing particles larger than No. 40 sieve size, mould a pat of soil to the consistency of putty, adding water if necessary. Allow the pat to dry completely by oven, sun or air drying, and then test its strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity.

High dry strength is characteristic for clays of the CH group. A typical inorganic silt possesses only very slight dry strength. Silty fine sands and silts have about the same slight dry strength, but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

Toughness (Consistency near plastic limit):

After removing particles larger than the No. 40 sieve size, a specimen of soil about one-half inch cube in size, is moulded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about one-eight inch in diameter. The thread is then folded and re-rolled repeatedly. During this manipulation the moisture content is gradually reduced and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached.

After the thread crumbles, the pieces should be lumped together and a slight kneading action continued until the lump crumbles.

The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil. Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic *clay of low plasticity, or materials such as kaolin-type clays and organic* clays which occur below the A-line.

Highly organic clays have a very weak and spongy feel at the plastic limit.

Consistency: Consistency descriptions of coarse-grained soils (GW, GP, GM, GC, SW, SP, SM, SC) are as follows.

Consistency	N Value (ASTM D 1586-67)
Very Loose	0 - 4
Loose	4 - 10
Medium Dense	10 - 30
Dense	30 - 50
Very Dense	>50

Consistency descriptions of fine-grained soils (ML, CL, MH, CH,) are as follows:

Consistency	Shear Strength (ksf)	Shear Strength (kn/m^2)	Field Guide
Very Soft	0.25	12	Sample with height equal to twice the diameter, sags under own weight
Soft	0.25-0.50	12 - 24	Can be squeezed between thumb and forefinger
Firm	0.50-1.00	24-48	Can be molded easily with fingers
Stiff	1.00-2.00	48-96	Can be imprinted with slight pressure from fingers
Very Stiff	2.00-4.00	96-192	Can be imprinted with considerable pressure from fingers
Hard	over 4.00	over 192	Cannot be imprinted by fingers

Grain Shape: Angular - particles have sharp edges and relatively plane sides with unpolished surfaces.

Subangular - particles are similar to angular but have somewhat rounded edges.

Subrounded - particles exhibit nearly plane sides but have well-rounded corners and edges.

Rounded - particles have smoothly curved sides and no edges.

Calcareous : Containing calcium carbonate; presence of calcium carbonate is commonly identified on the basis of reaction with dilute hydrochloric acid.

Caliche : Soils cemented by porous calcium carbonate and/or other soluble minerals by upward-moving solutions.

Degree of Cementation: (Stages of development of caliche profile)

Stage	Gravelly Soils	Nongravelly Soils
I	Thin, discontinuous pebble coatings	Few filaments or faint coatings
II	Continuous pebble coatings, some interpebble fillings	Few to abundant nodules, flakes, filaments
III	Many interpebble fillings	Many nodules and internodular fillings
IV	Laminar horizon overlying plugged horizon	Increasing carbonate impregnation

Secondary Material : Example - Sand with trace to some silt

Trace - 5-12% (by dry weight)
Little - 13-20% (by dry weight)
Some - >21% (by dry weight)

Plasticity : Plasticity index is the range of water content, expressed as a percentage of the weight of the oven-dried soil, through which the soil is plastic. It is defined as the liquid limit minus the plastic limit. Descriptive ranges used on the logs include:

Nonplastic	(PI, 0 - 4)
Slightly Plastic	(PI, 4 - 15)
Medium Plastic	(PI, 15 - 30)
Highly Plastic	(PI, >31)

Cobbles and Boulders : A cobble is a rock fragment, usually rounded by weathering or abrasion, with an average diameter ranging between 3 and 12 inches (8 and 30 cm).

A boulder is a rock fragment, usually rounded by weathering or abrasion, with an average diameter of 12 inches (30 cm) or more.

I. Remarks - This column was provided on boring and trench logs for comments regarding drilling difficulty, number and size of cobbles or boulders encountered, trench wall stability, loss of drilling fluid in the boring, and other conditions encountered during drilling and excavations.

J. Dry Density and Moisture Content - The boring logs include a graphical display of laboratory test results for dry density (ASTM D 2937-71) in pounds per cubic foot and kilograms per cubic meter and moisture content (ASTM D 2216-71) in percent from representative samples taken during drilling. The symbols are explained at the bottom of the boring logs.

K. Seive Analysis - The numbers represent the percentage by dry weight (ASTM D 422-63) of each of the following soil components:

GR - Gravel, rock particles that will pass a 3-inch (76 mm) sieve and are retained on No. 4 (4.75 mm) sieve.

SA - Sand, soil particles passing No. 4 sieve and retained on No. 200 (0.075 mm) sieve.

FI - Fines, silt or clay, soil particles passing No. 200 sieve.

L. Atterberg Limits (LL and PI) -

LL - Liquid Limit, the water content corresponding to the arbitrary limit between the liquid and plastic states of consistency of a soil (ASTM D 423-66).

PL - Plastic Limit, the water content corresponding to an arbitrary limit between the plastic and the semisolid state of consistency of a soil (ASTM D 424-59).

PI - Plasticity Index, numerical difference between the liquid limit (LL) and the plastic limit (PL) indicating the range of moisture content within which a soil-water mixture is plastic.

NP - Nonplastic.

M. Miscellaneous Information -

Elevations - indicated elevations on the logs are estimated from topographic maps of the study area, within an accuracy of half the contour interval.

Surficial Geologic Unit - indicates the surficial geologic unit in which the activity is located.

Date Drilled - indicates the period from beginning to completion of the activity.

Drilling Method - signifies the type of drilling procedure used such as rotary wash.

Hole Diameter - nominal size of boring drilled.

Water Level - indicates depth from ground surface to water table where encountered.

Trench Length - length at ground surface of final trench excavation.

Trench Orientation - bearing of longitudinal trench centerline.

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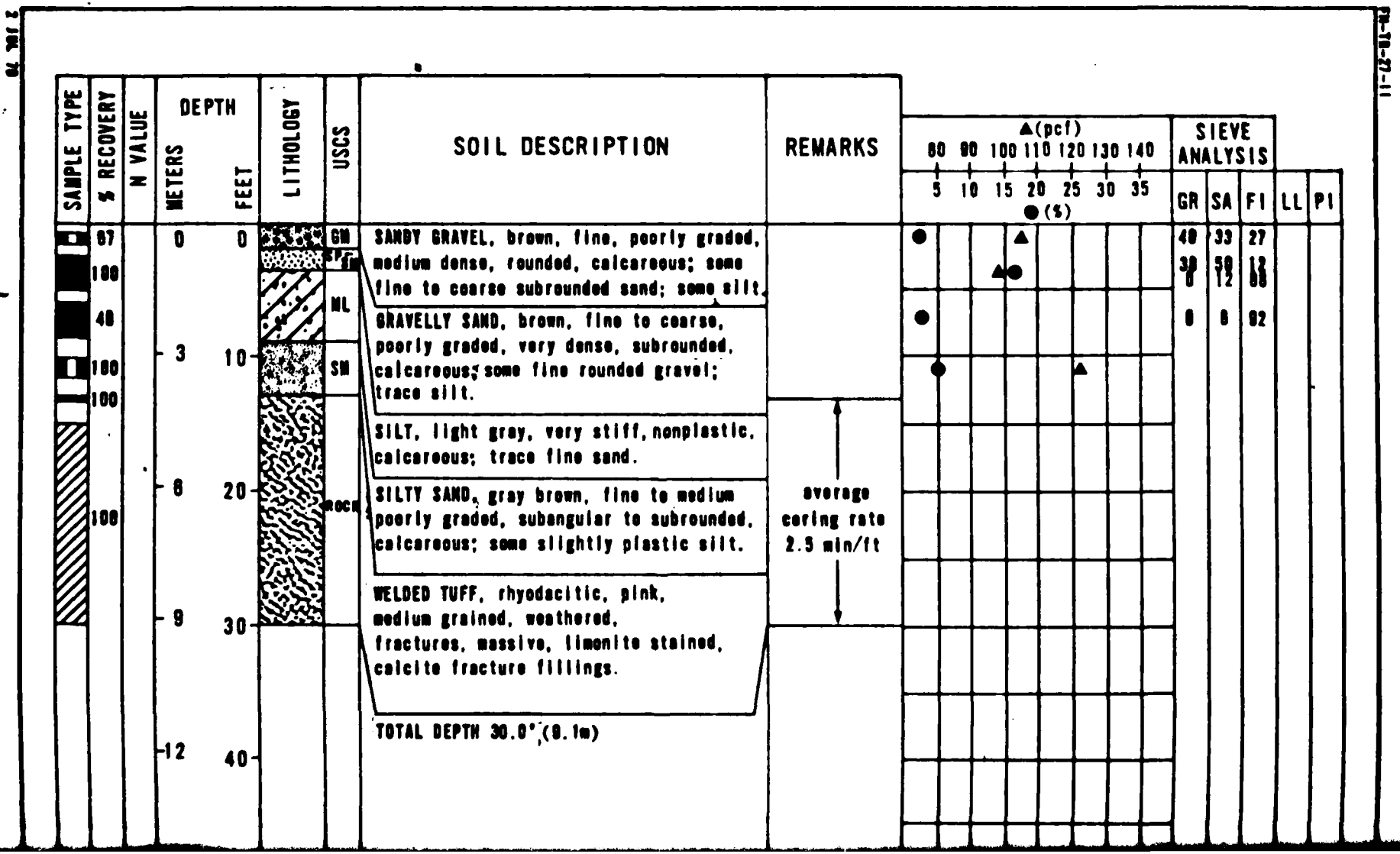

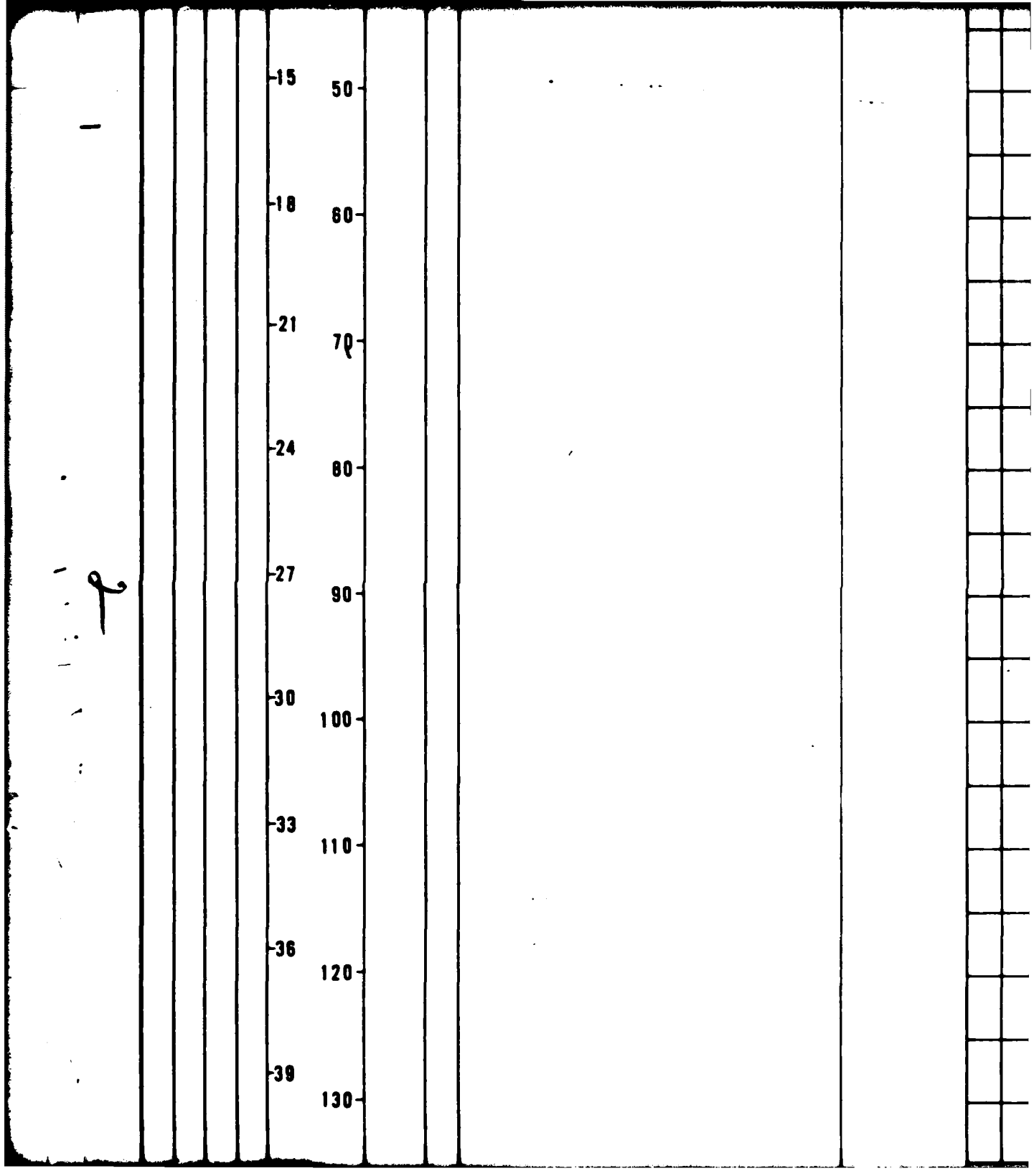
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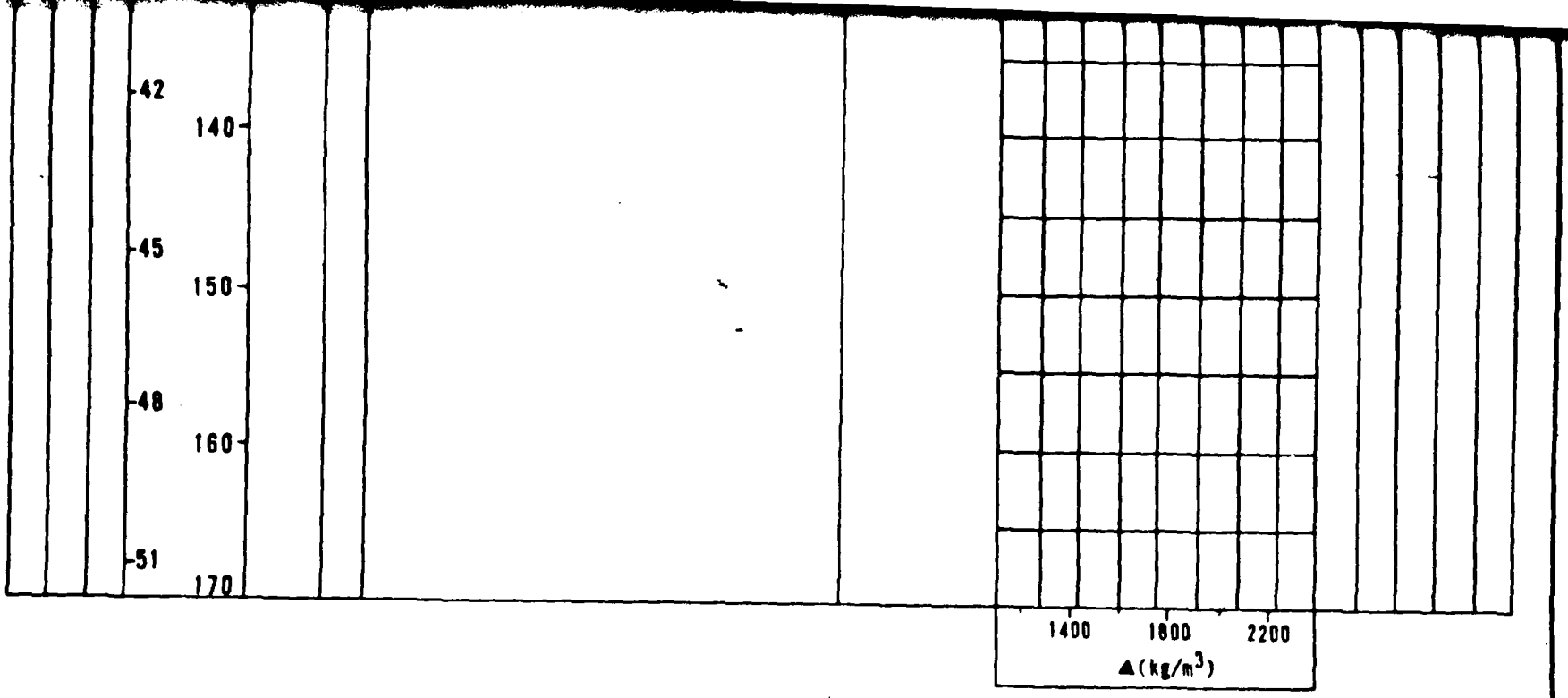
100
110
120
130



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	: 5033' (1534m)
SURFICIAL GEOLOGIC UNIT	: A4o
DATE DRILLED	: 18 October 1978
DRILLING METHOD	: Rotary Wash
HOLE DIAMETER	: 4 7/8" (124mm)
WATER LEVEL	: Not Encountered

LOG OF BORING MW-1
VERIFICATION SITE, WHIRLWIND CRP, UTAH

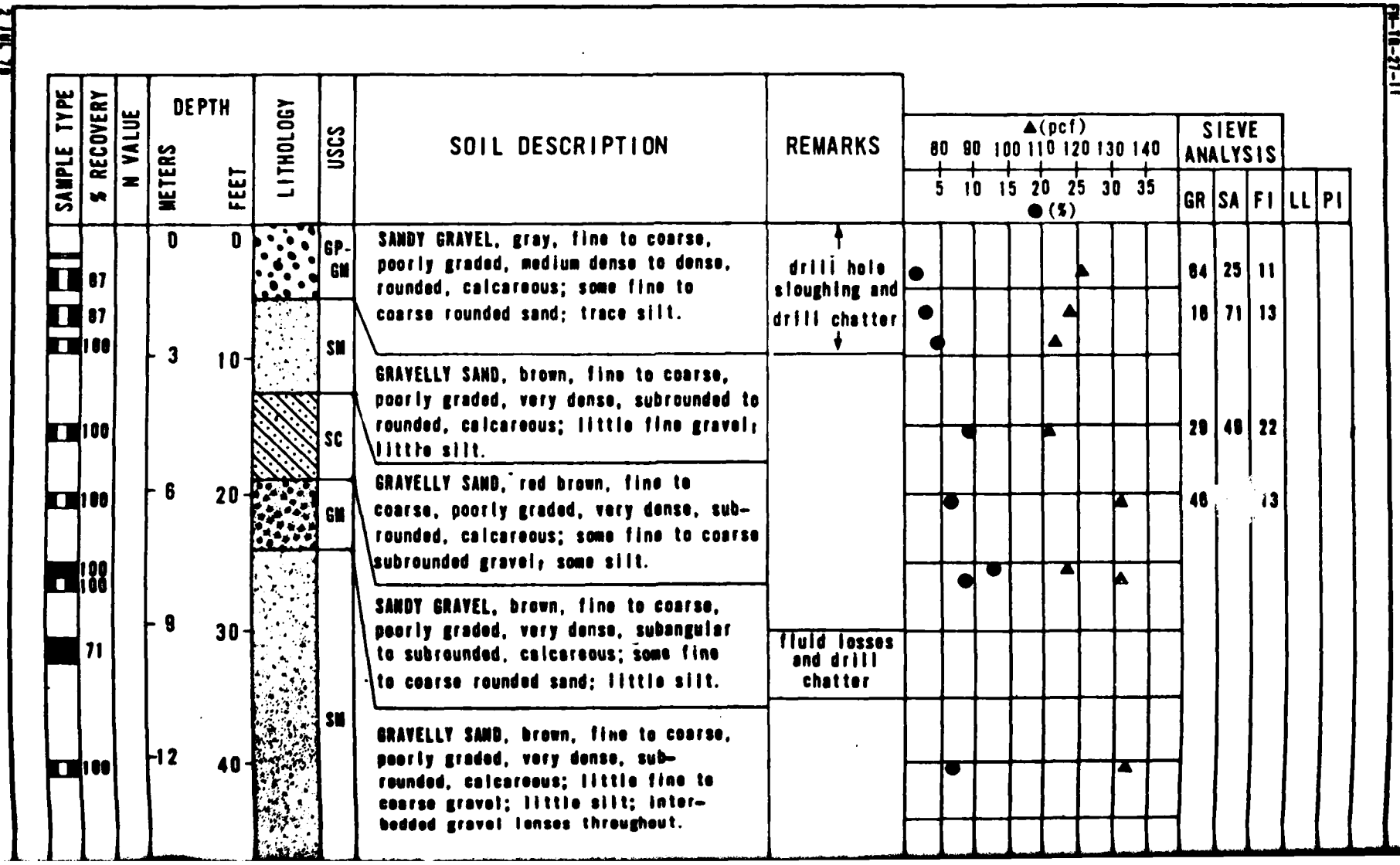
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

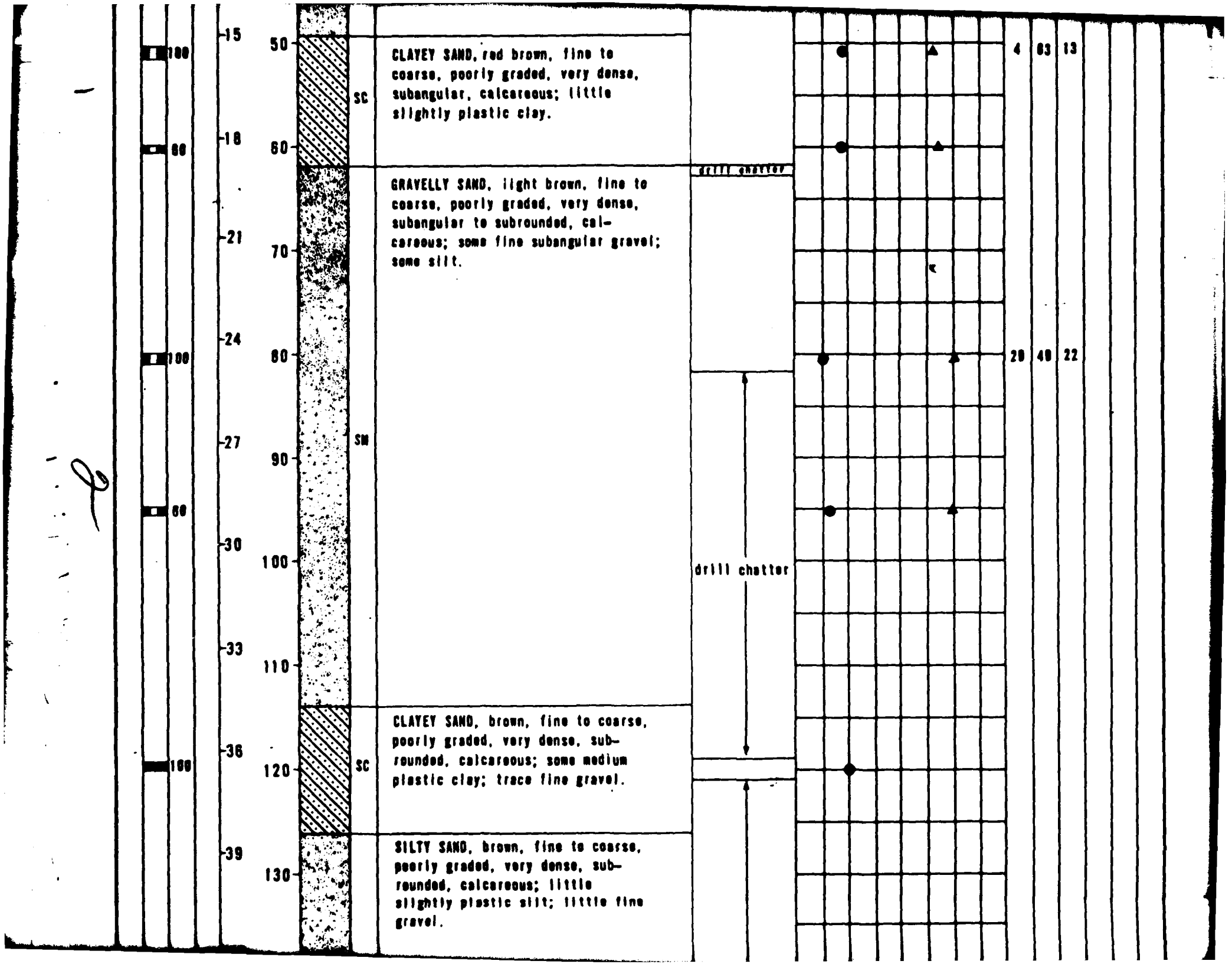
FIGURE 6-1

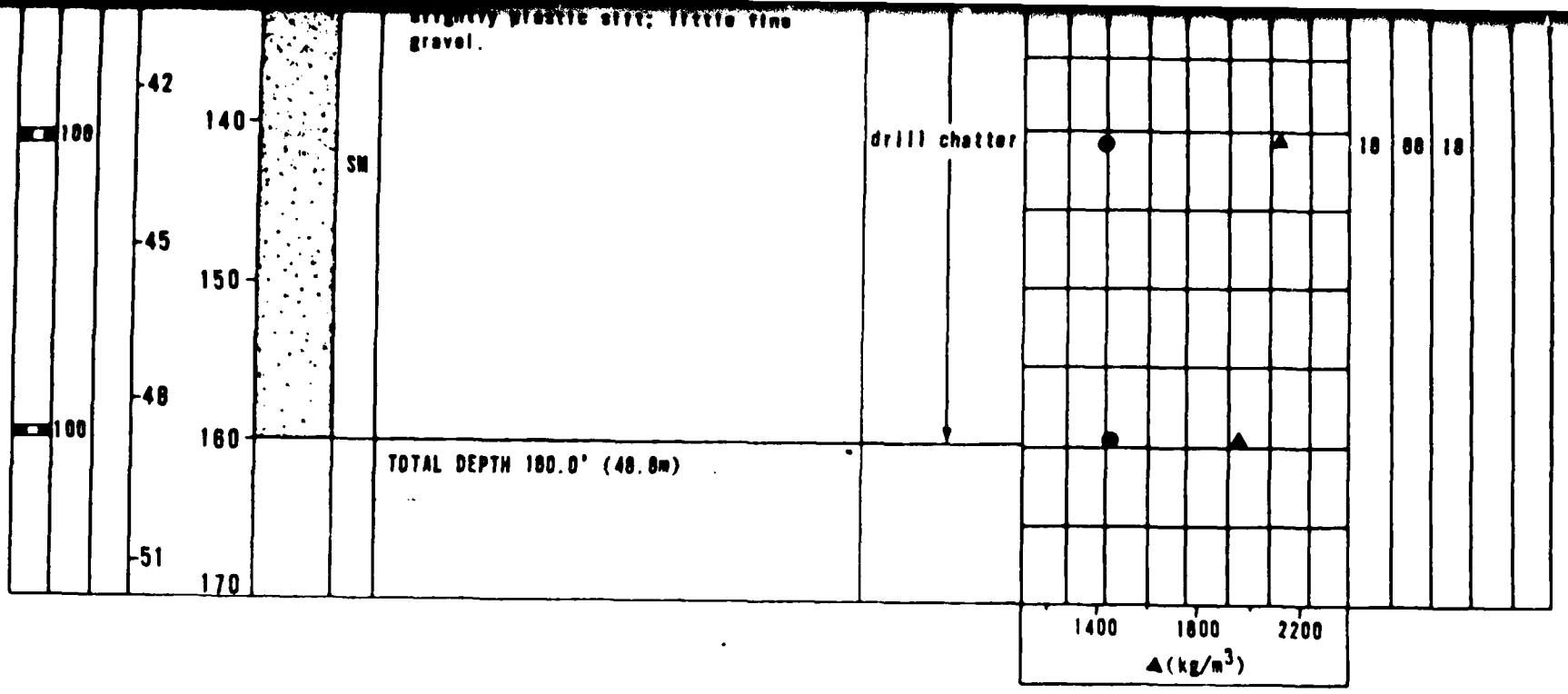
FUGRO NATIONAL, INC.

3

CHECKED BY _____ APPROVED BY _____




100
60
100
60
100
-15
-18
-21
-24
-27
-30
-33
-36
-39
50
60
70
80
90
100
110
120
130
SC
SM
SC
CLAYEY SAND, red brown, fine to coarse, poorly graded, very dense, subangular, calcareous; little slightly plastic clay.
GRAVELLY SAND, light brown, fine to coarse, poorly graded, very dense, subangular to subrounded, calcareous; some fine subangular gravel; some silt.
CLAYEY SAND, brown, fine to coarse, poorly graded, very dense, subrounded, calcareous; some medium plastic clay; trace fine gravel.
SILTY SAND, brown, fine to coarse, poorly graded, very dense, subrounded, calcareous; little slightly plastic silt; little fine gravel.
drill chatter
drill chatter
4 83 13
20 48 22



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	: 5260' (1603m)
SURFICIAL GEOLOGIC UNIT	: A5i
DATE DRILLED	: 16-19 October 1978
DRILLING METHOD	: Rotary Wash
HOLE DIAMETER	: 4 7/8" (124mm)
WATER LEVEL	: Not Encountered

FUGRO NATIONAL, INC.

LOG OF BORING W-4-2
VERIFICATION SITE, WHIRLWIND COR, UTAH
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO
FIGURE 8-2

APG-8

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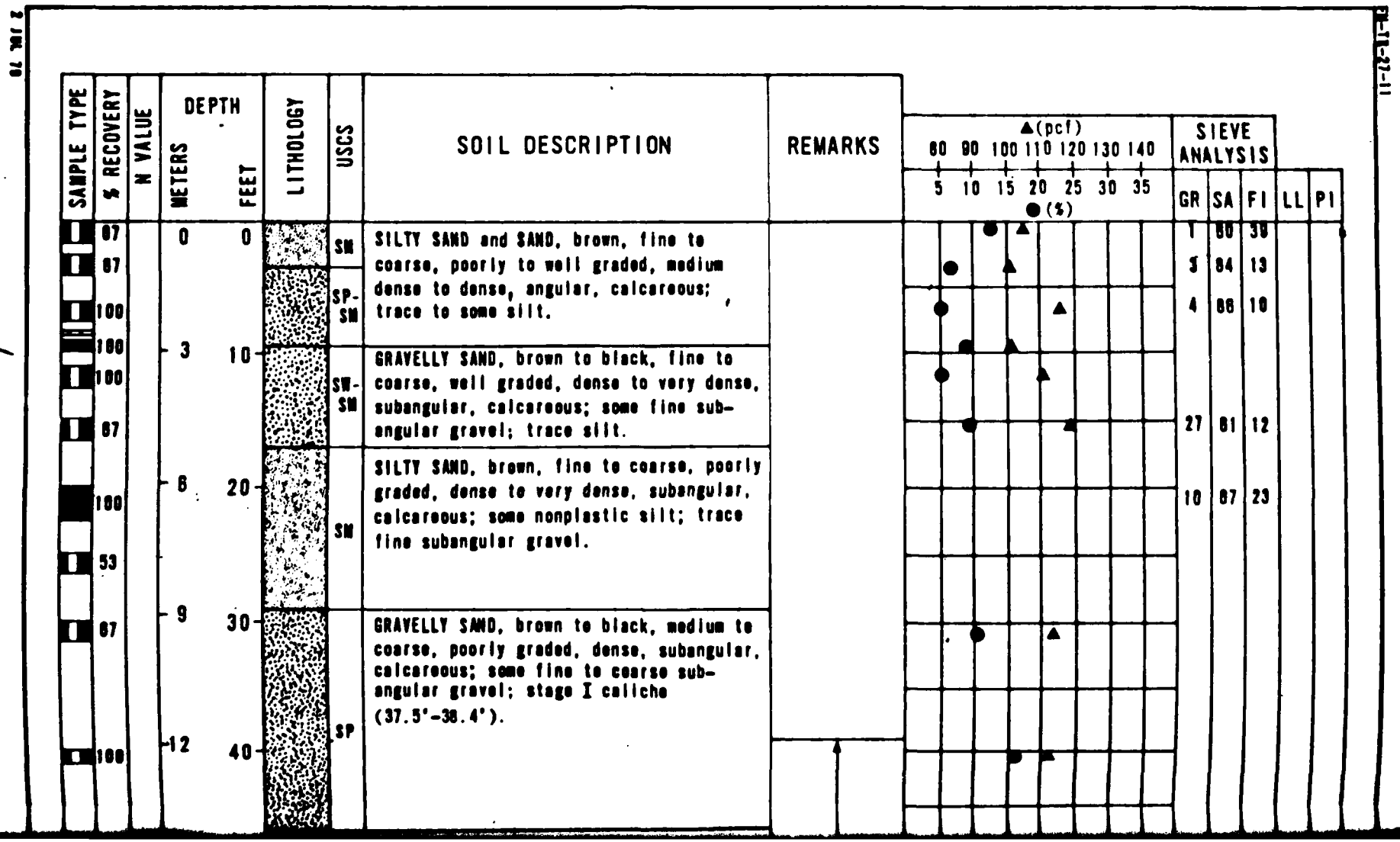

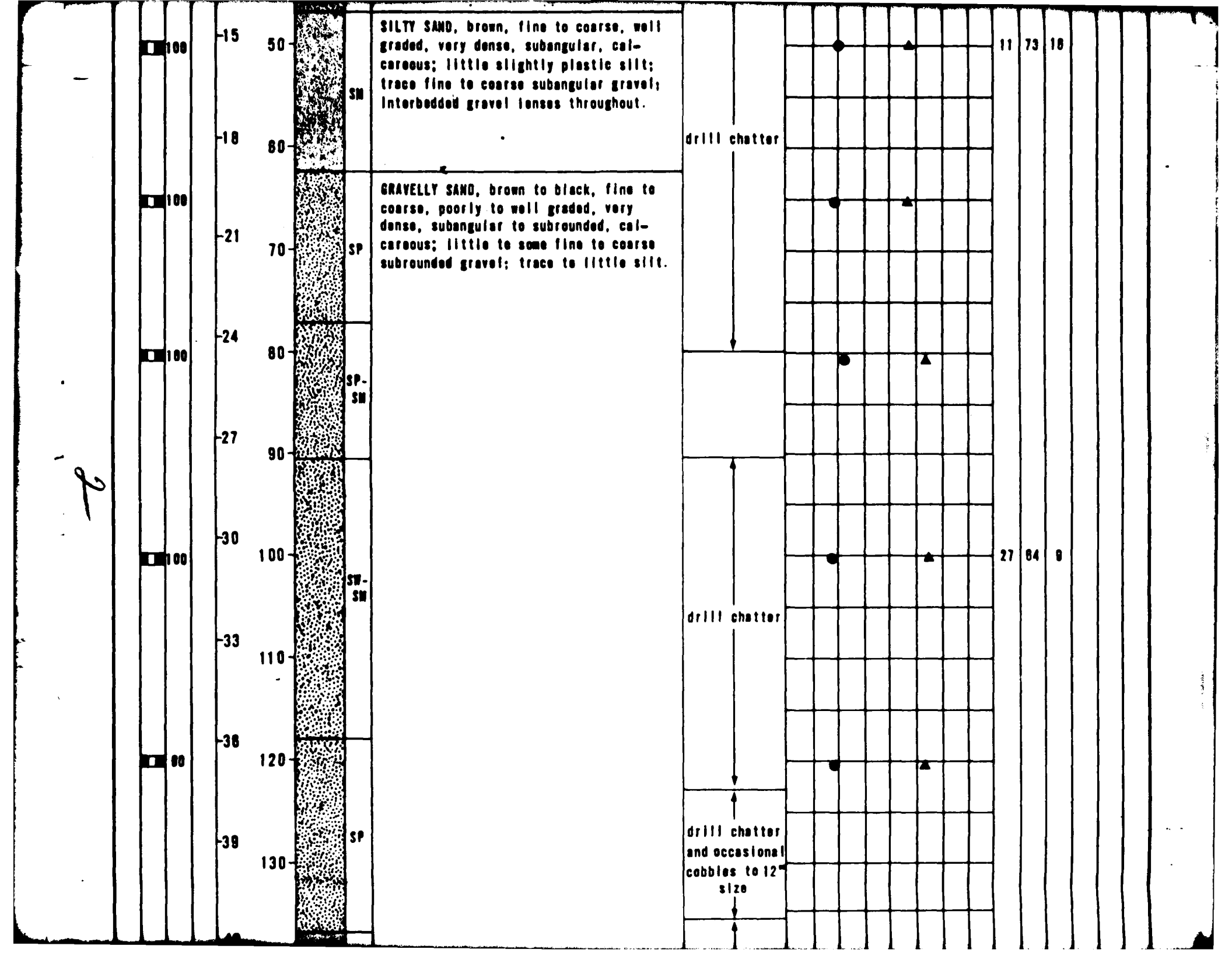
100
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60
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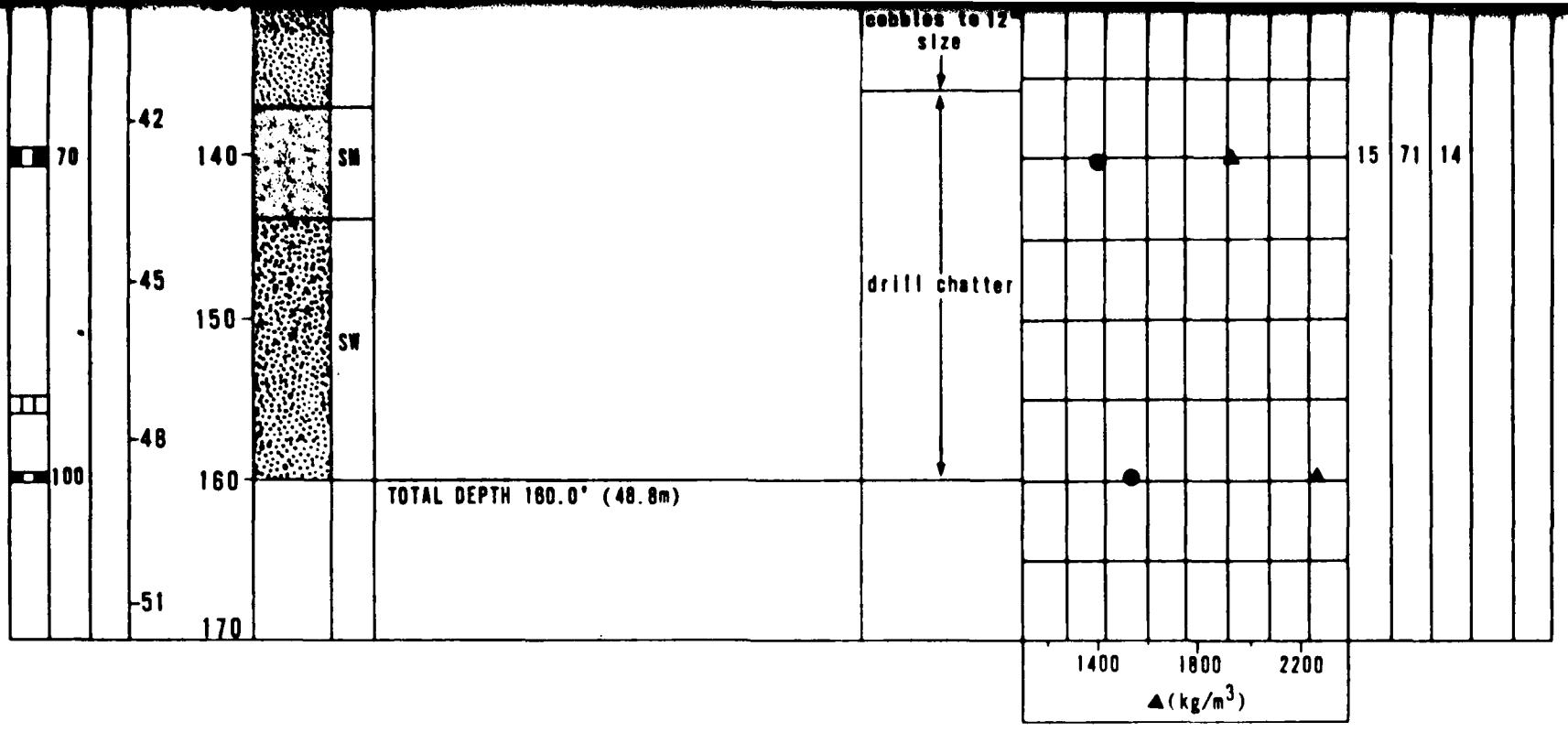
100
110
120
130
SM
SP
SP-SM
SW-SM
SP
SILTY SAND, brown, fine to coarse, well graded, very dense, subangular, calcareous; little slightly plastic silt; trace fine to coarse subangular gravel; interbedded gravel lenses throughout.
GRAVELLY SAND, brown to black, fine to coarse, poorly to well graded, very dense, subangular to subrounded, calcareous; little to some fine to coarse subrounded gravel; trace to little silt.
drill chatter
drill chatter
drill chatter and occasional cobbles to 12" size
11 73 16
27 64 9



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N – STANDARD PENETRATION RESISTANCE
- ▲ – DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● – MOISTURE CONTENT (ASTM: D-2216-71)
- NR – NO RECOVERY

BORING DETAILS

ELEVATION	: 5275' (1608m)
SURFICIAL GEOLOGIC UNIT	: A5I
DATE DRILLED	: 20-21 October 1978
DRILLING METHOD	: Rotary Wash
HOLE DIAMETER	: 4 7/8" (124mm)
WATER LEVEL	: Not Encountered

FUGRO NATIONAL, INC.

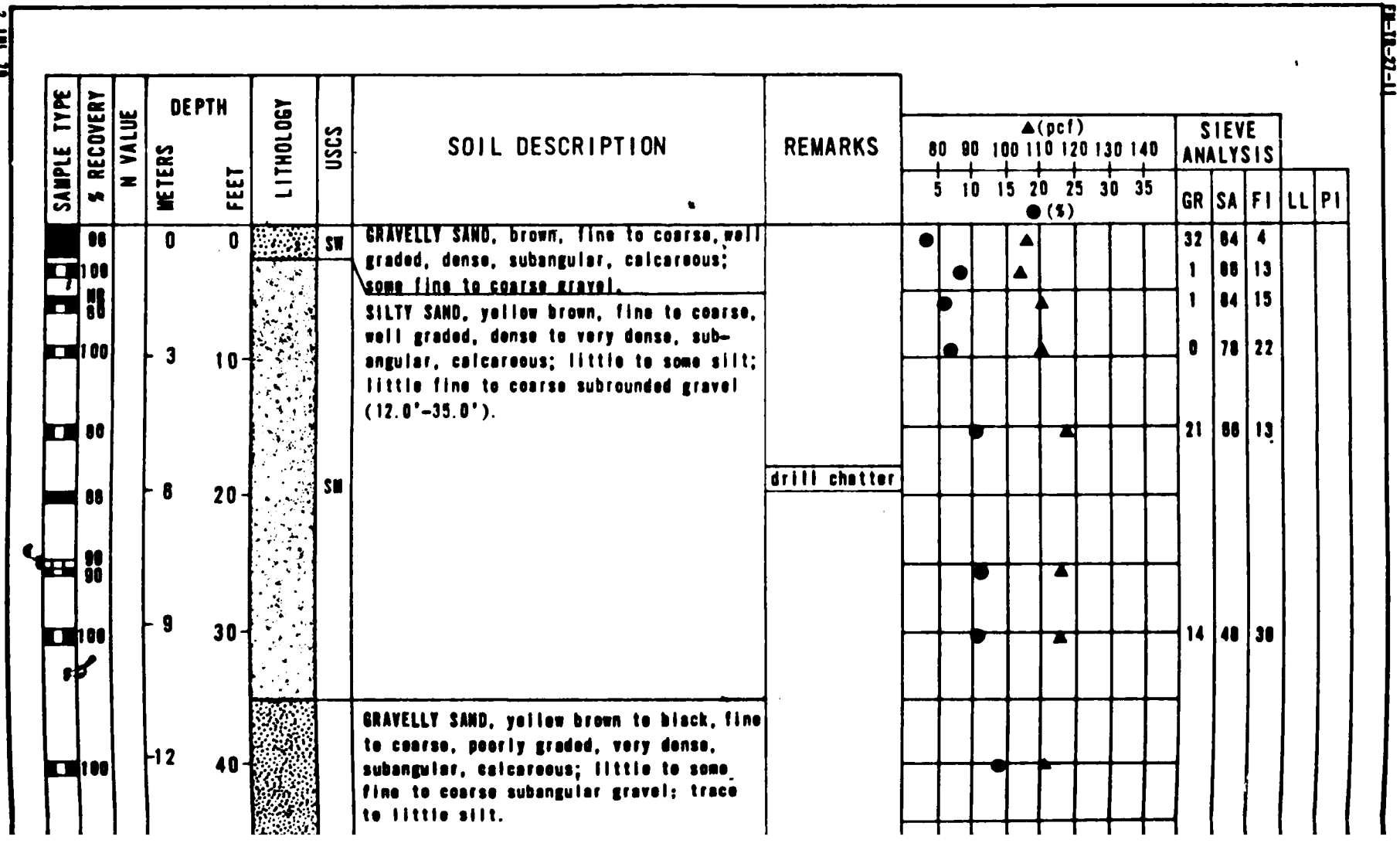
LOG OF BORING VB-b-3
VERIFICATION SITE, WHIRLWIND COP, UTAH

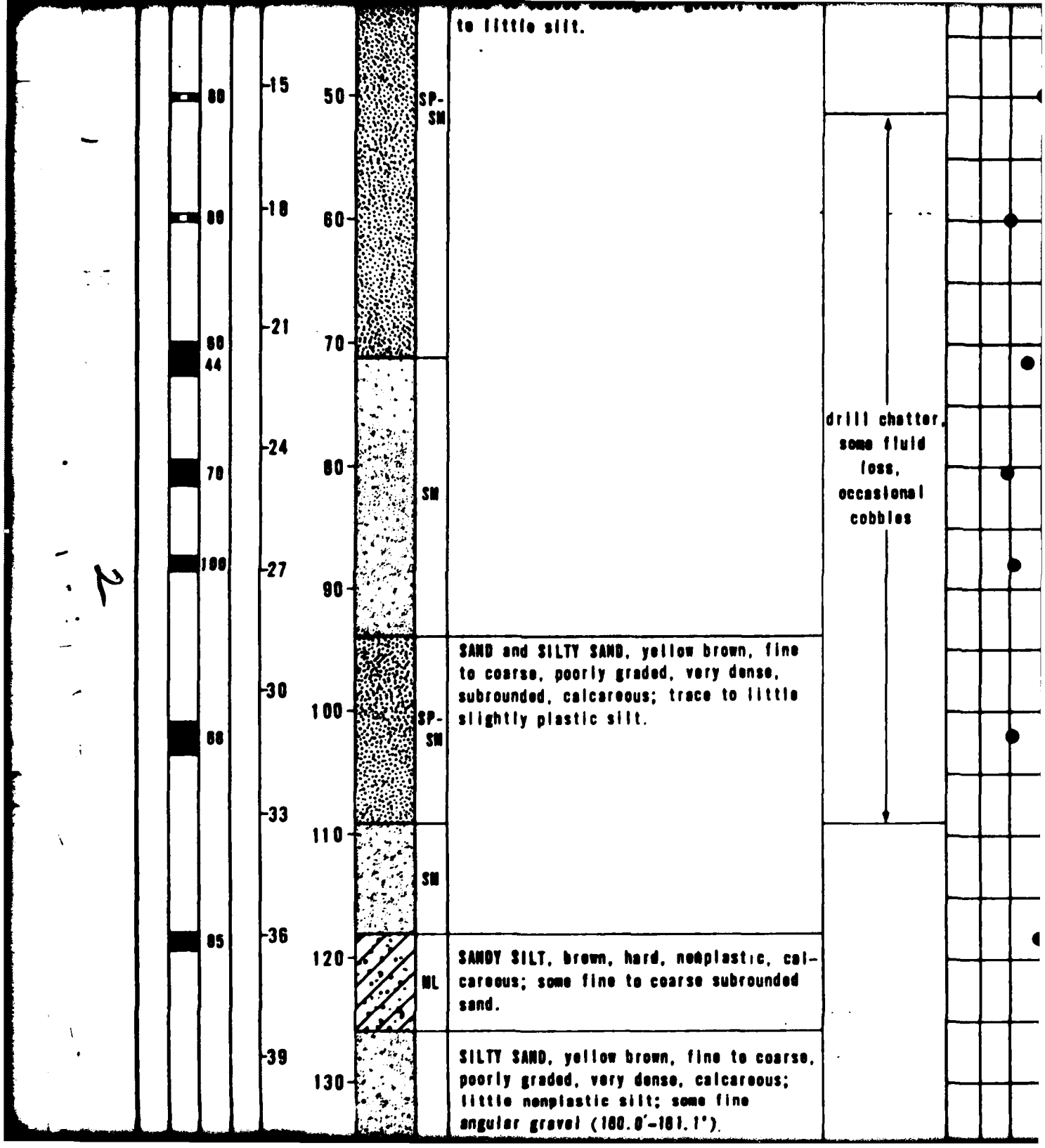
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAMSO

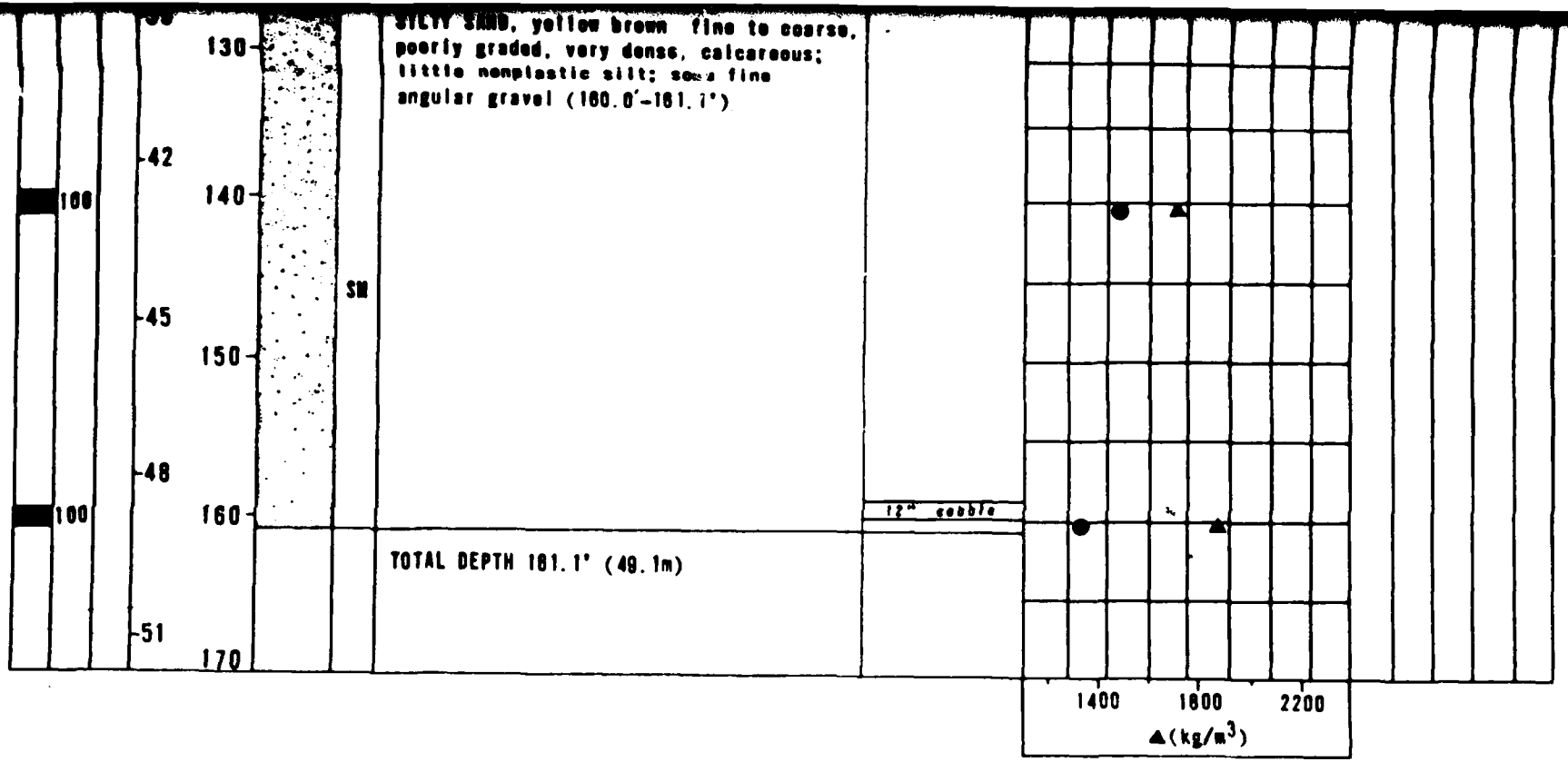
FIGURE 6-3

AFT-8

CHECKED BY _____ APPROVED BY _____




to little silt.
SP-SM
SM
SAND and SILTY SAND, yellow brown, fine to coarse, poorly graded, very dense, subrounded, calcareous; trace to little slightly plastic silt.
SP-SM
SM
SANDY SILT, brown, hard, nonplastic, calcareous; some fine to coarse subrounded sand.
ML
SILTY SAND, yellow brown, fine to coarse, poorly graded, very dense, calcareous; little nonplastic silt; some fine angular gravel (180.0'-181.1').
drill chatter, some fluid loss, occasional cobbles
80
80
80
44
70
100
68
85
15
18
21
24
27
30
33
36
39
50
60
70
80
90
100
110
120
130



EXPLANATION

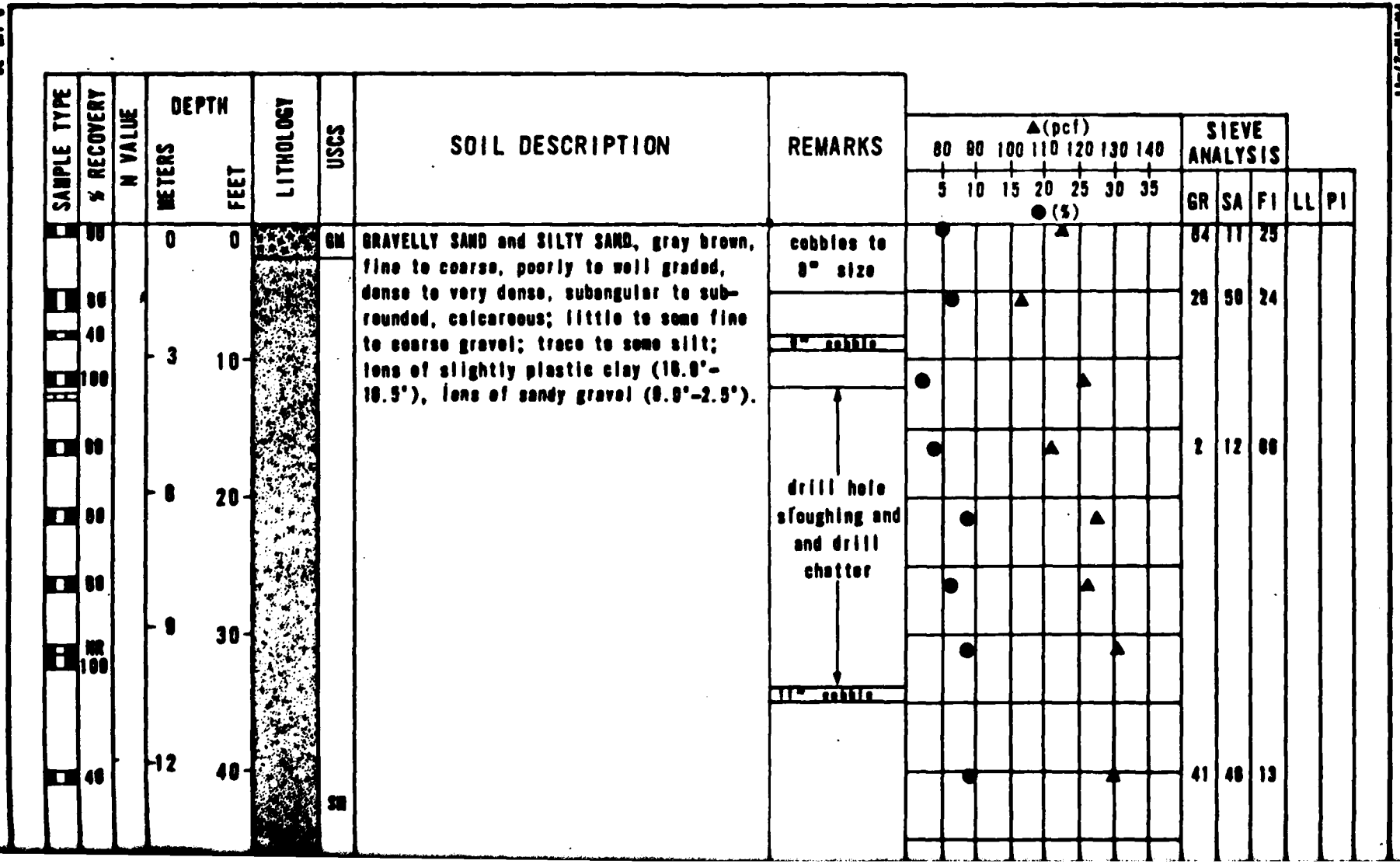
- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

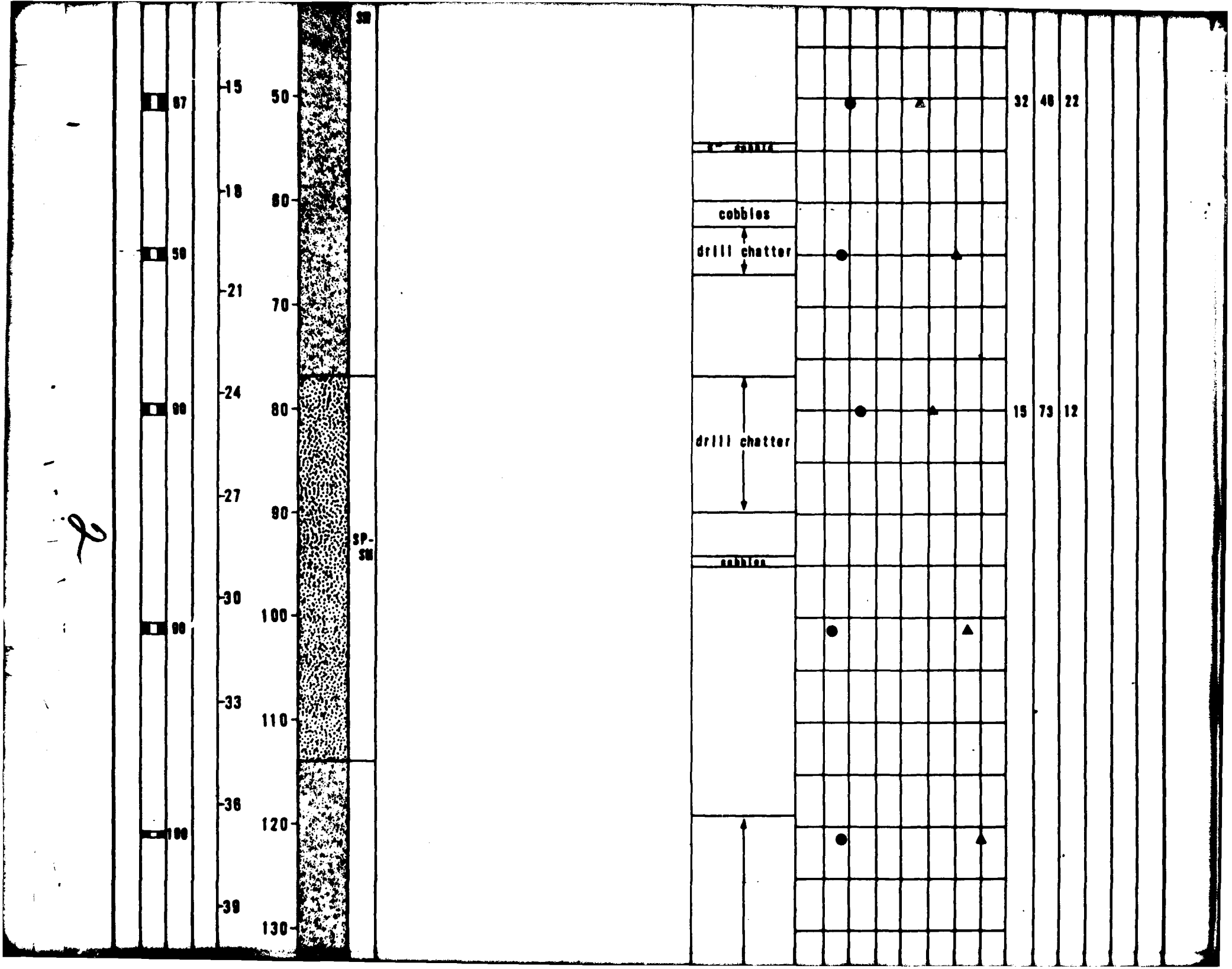
BORING DETAILS

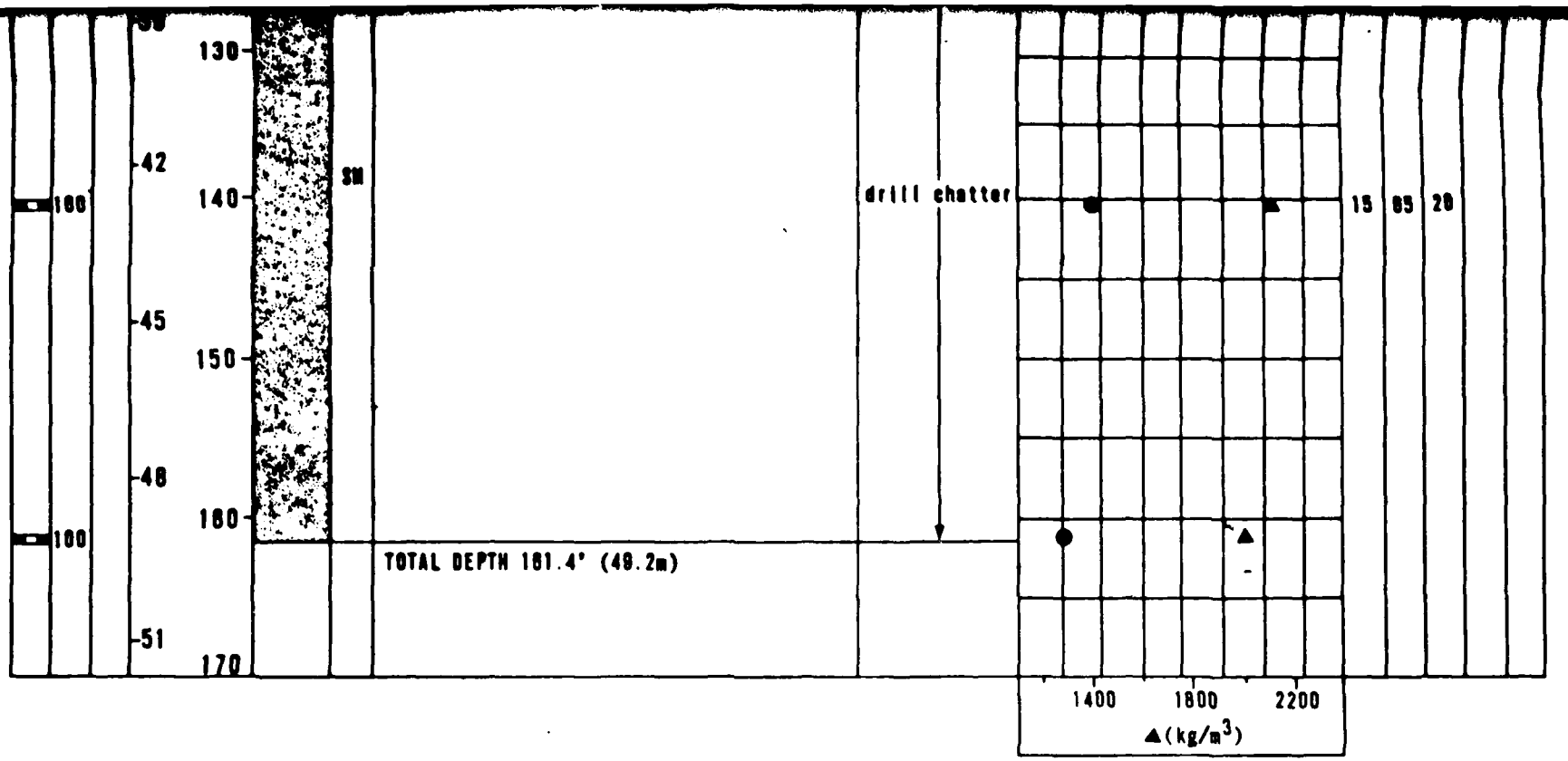
ELEVATION	: 5026' (1532m)
SURFICIAL GEOLOGIC UNIT	: A5y/A4o
DATE DRILLED	: 21-22 October 1978
DRILLING METHOD	: Rotary Wash
HOLE DIAMETER	: 4 7/8" (124mm)
WATER LEVEL	: Not Encountered

LOG OF BORING MW-4-4
VERIFICATION SITE, WHIRLWIND CRP, UTAH
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO
FIGURE 6-4
FUGRO NATIONAL, INC.

CHECKED BY _____ APPROVED BY _____




87
50
99
99
100
15
18
21
24
27
30
33
36
39
50
60
70
80
90
100
110
120
130
SM
SP-SM
cobbles
drill chatter
drill chatter
cobbles
32 46 22
15 73 12



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	: 5440' (1658m)
SURFICIAL GEOLOGIC UNIT	: A5I
DATE DRILLED	: 23 October 1978
DRILLING METHOD	: Rotary Wash
HOLE DIAMETER	: 4 7/8" (124mm)
WATER LEVEL	: Not Encountered

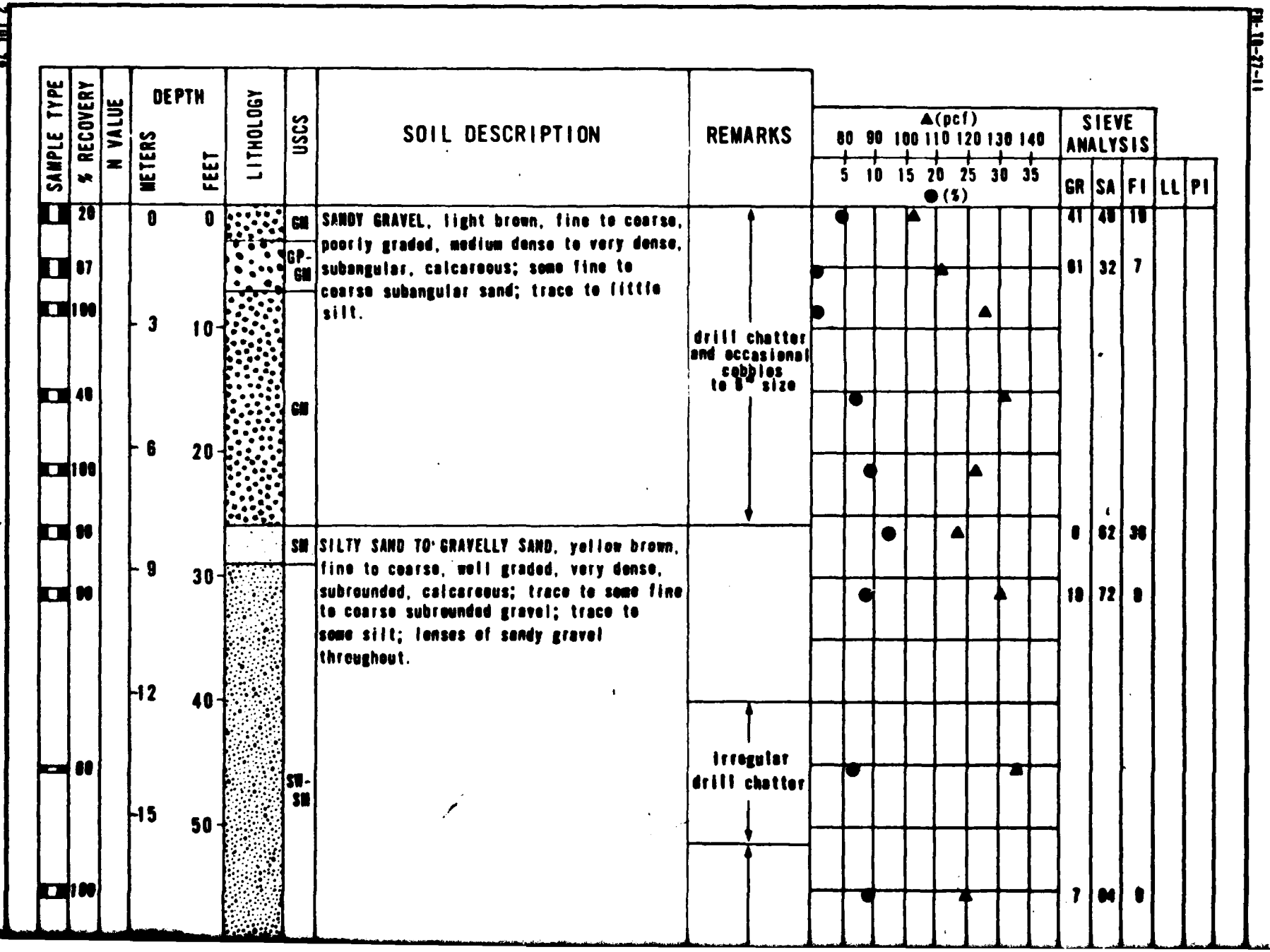
FUGRO NATIONAL, INC.

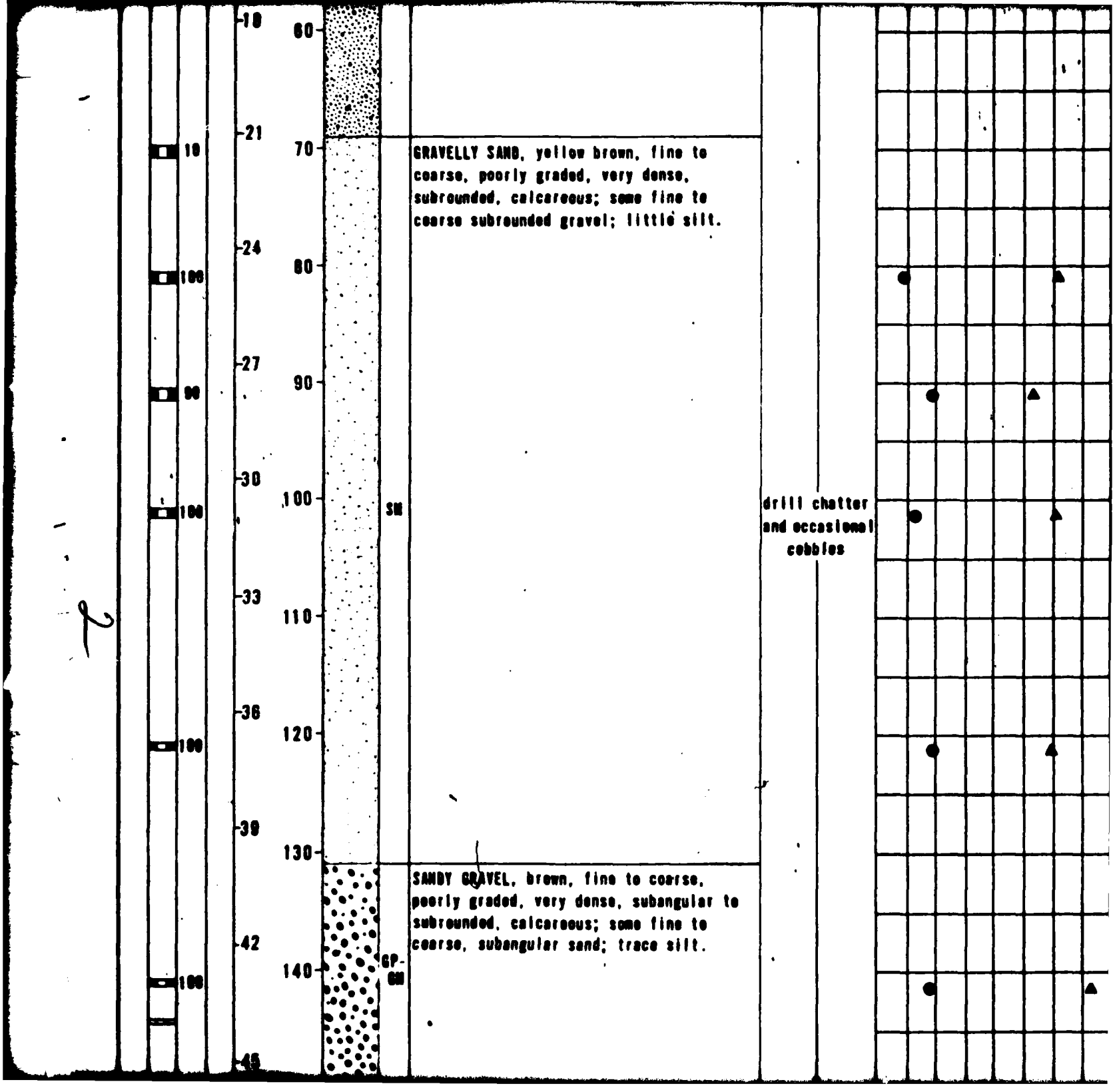
LOG OF BORING WM-6-5, VERIFICATION SITE, WHIRLWIND CRP, UTAH

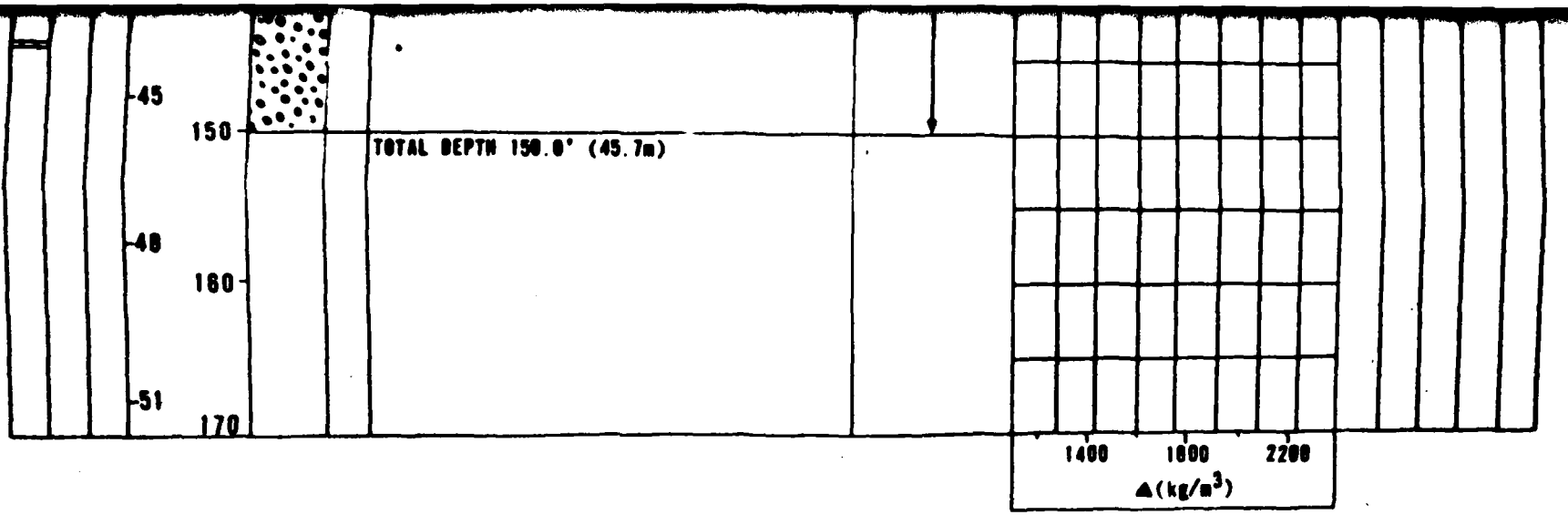
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 6-5

CHECKED BY_____ APPROVED BY_____




60
70
80
90
100
110
120
130
140
-18
-21
-24
-27
-30
-33
-36
-39
-42
-45
18
100
90
100
100
GRAVELLY SAND, yellow brown, fine to coarse, poorly graded, very dense, subrounded, calcareous; some fine to coarse subrounded gravel; little silt.
SW
SANDY GRAVEL, brown, fine to coarse, poorly graded, very dense, subangular to subrounded, calcareous; some fine to coarse, subangular sand; trace silt.
GP-GW
drill chatter and occasional cobbles



EXPLANATION

- FUGRO DRIVE SAMPLE
- BULK SAMPLE
- PITCHER TUBE SAMPLE
- STANDARD PENETRATION TEST SAMPLE
- CORE SAMPLE
- N - STANDARD PENETRATION RESISTANCE
- ▲ - DRY UNIT WEIGHT (ASTM: D-2937-71)
- ● - MOISTURE CONTENT (ASTM: D-2216-71)
- NR - NO RECOVERY

BORING DETAILS

ELEVATION	: 5058' (1542m)
SURFICIAL GEOLOGIC UNIT	: A5y/A4o
DATE DRILLED	: 24 - 25 October 1978
DRILLING METHOD	: Rotary Wash
HOLE DIAMETER	: 4 7/8" (124mm)
WATER LEVEL	: Not Encountered

FUGRO NATIONAL, INC.

LOG OF BORING WM-B-6
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAMSO

FIGURE B-6

APT-B

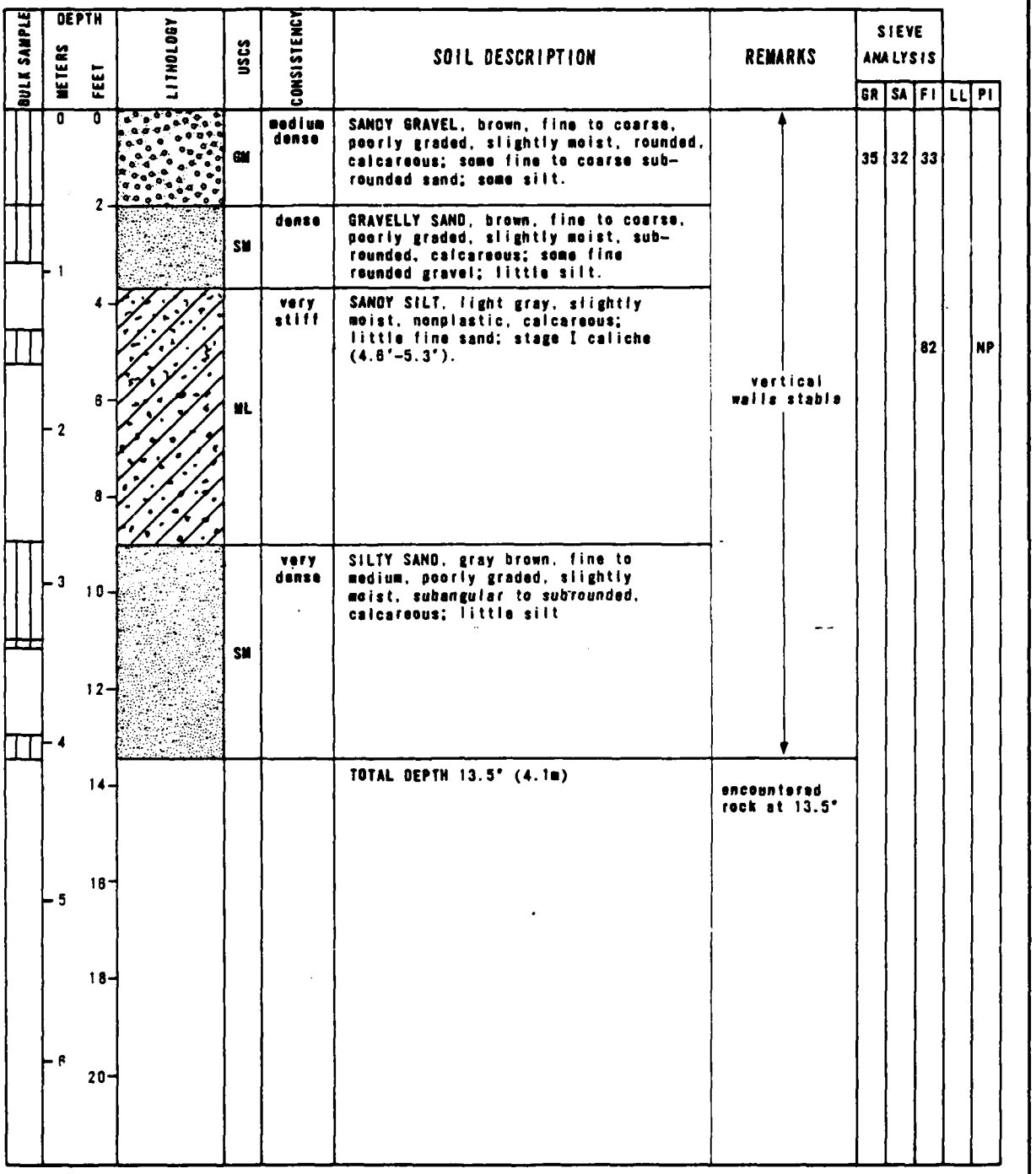
SECTION 7.0

TRENCH AND TEST PIT LOGS

EXPLANATIONS OF TRENCH AND TEST PIT LOGS

See Section 6.0, "Boring Logs", for explanations.

FN-TR-27-11



BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		GM	medium dense	SANDY GRAVEL, brown, fine to coarse, poorly graded, slightly moist, rounded, calcareous; some fine to coarse sub-rounded sand; some silt.	vertical walls stable	35	32	33		
		2		SM	dense	GRAVELLY SAND, brown, fine to coarse, poorly graded, slightly moist, sub-rounded, calcareous; some fine rounded gravel; little silt.						
	1	4		ML	very stiff	SANDY SILT, light gray, slightly moist, nonplastic, calcareous; little fine sand; stage I caliche (4.6'-5.3').				82		NP
	2	6										
		8										
	3	10		SM	very dense	SILTY SAND, gray brown, fine to medium, poorly graded, slightly moist, subangular to subrounded, calcareous; little silt						
		12										
	4											
		14				TOTAL DEPTH 13.5' (4.1m)	encountered rock at 13.5'					
	5	16										
		18										
	6	20										

CHECKED BY _____ APPROVED BY _____

TRENCH DETAILS

SURFACE ELEVATION : 5033' (1534m)
DATE EXCAVATED : 18 OCT 1978
SURFICIAL GEOLOGIC UNIT : A4e
TRENCH LENGTH : 17.5' (5.3m)
TRENCH ORIENTATION : ENE - WSW

LOG OF TRENCH WW-T-1
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

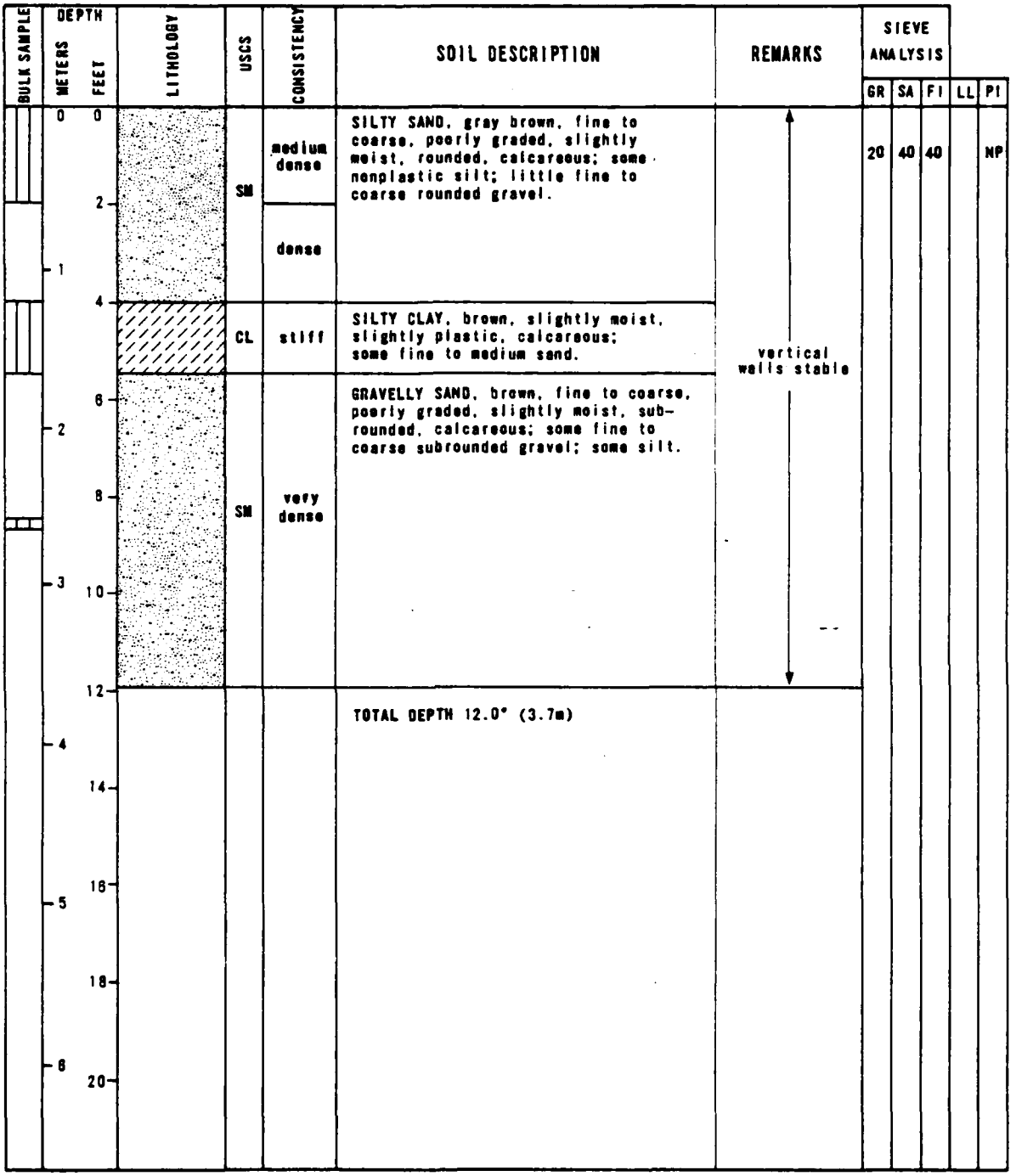
FIGURE 7-1

FUGRO NATIONAL, INC.

2 JUL 79

AFV-04

FN-TR-27-11



CHECKED BY _____ APPROVED BY _____

TRENCH DETAILS

SURFACE ELEVATION : 5260' (1603m)
DATE EXCAVATED : 19 OCTOBER 1978
SURFICIAL GEOLOGIC UNIT : ASI
TRENCH LENGTH : 14.0' (4.3m)
TRENCH ORIENTATION : ENE - WSW

LOG OF TRENCH WW-T-2
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

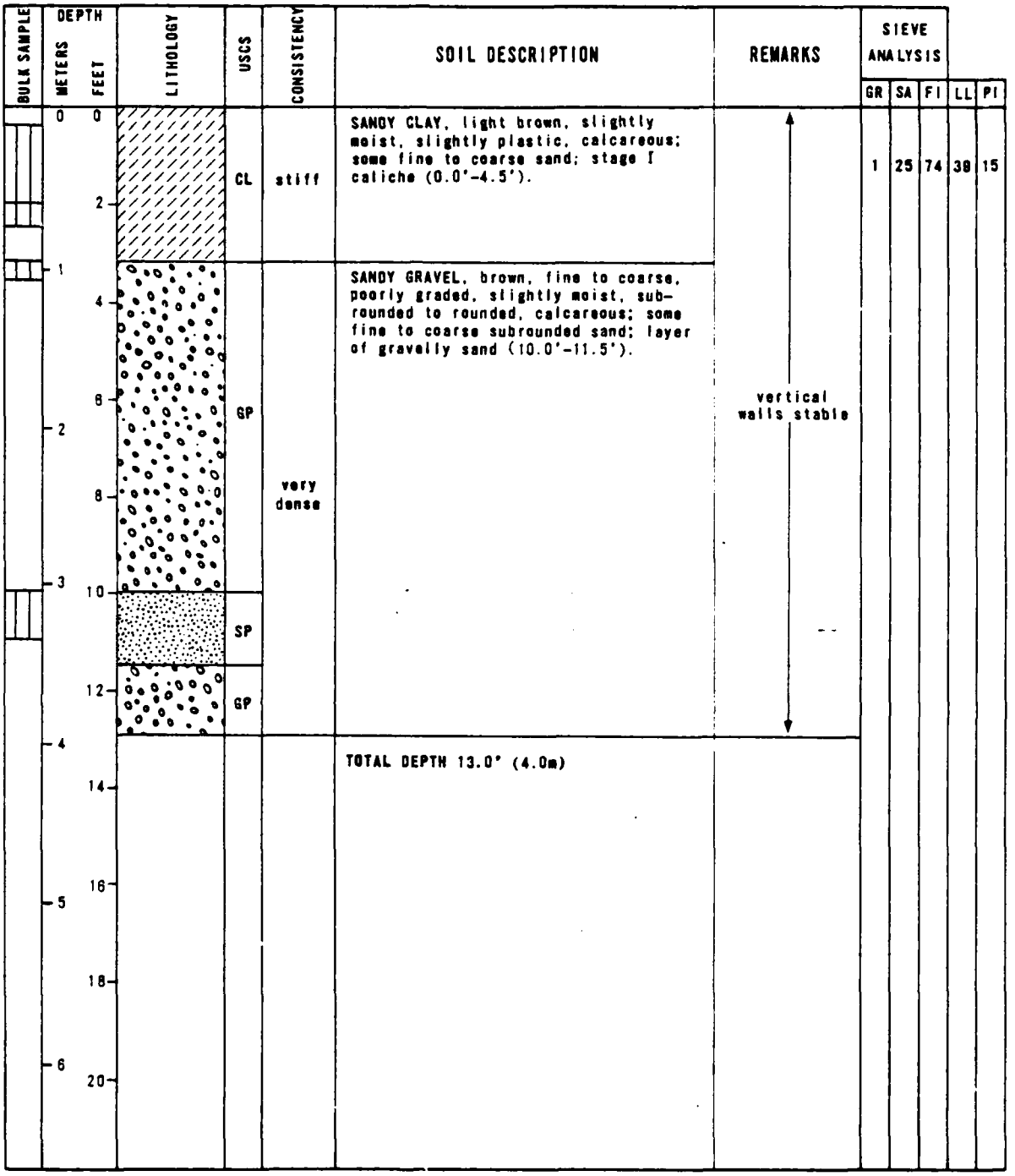
FIGURE 7-2

FUGRO NATIONAL, INC.

2 JUL 79

AFV-04

FN-TR-27-11



TRENCH DETAILS

SURFACE ELEVATION : 5003' (1525m)
DATE EXCAVATED : 20 OCTOBER 1978
SURFICIAL GEOLOGIC UNIT : A5y/A4e
TRENCH LENGTH : 15.0' (4.8m)
TRENCH ORIENTATION : E - W

LOG OF TRENCH WW-T-3
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 7-3

FUGRO NATIONAL, INC.

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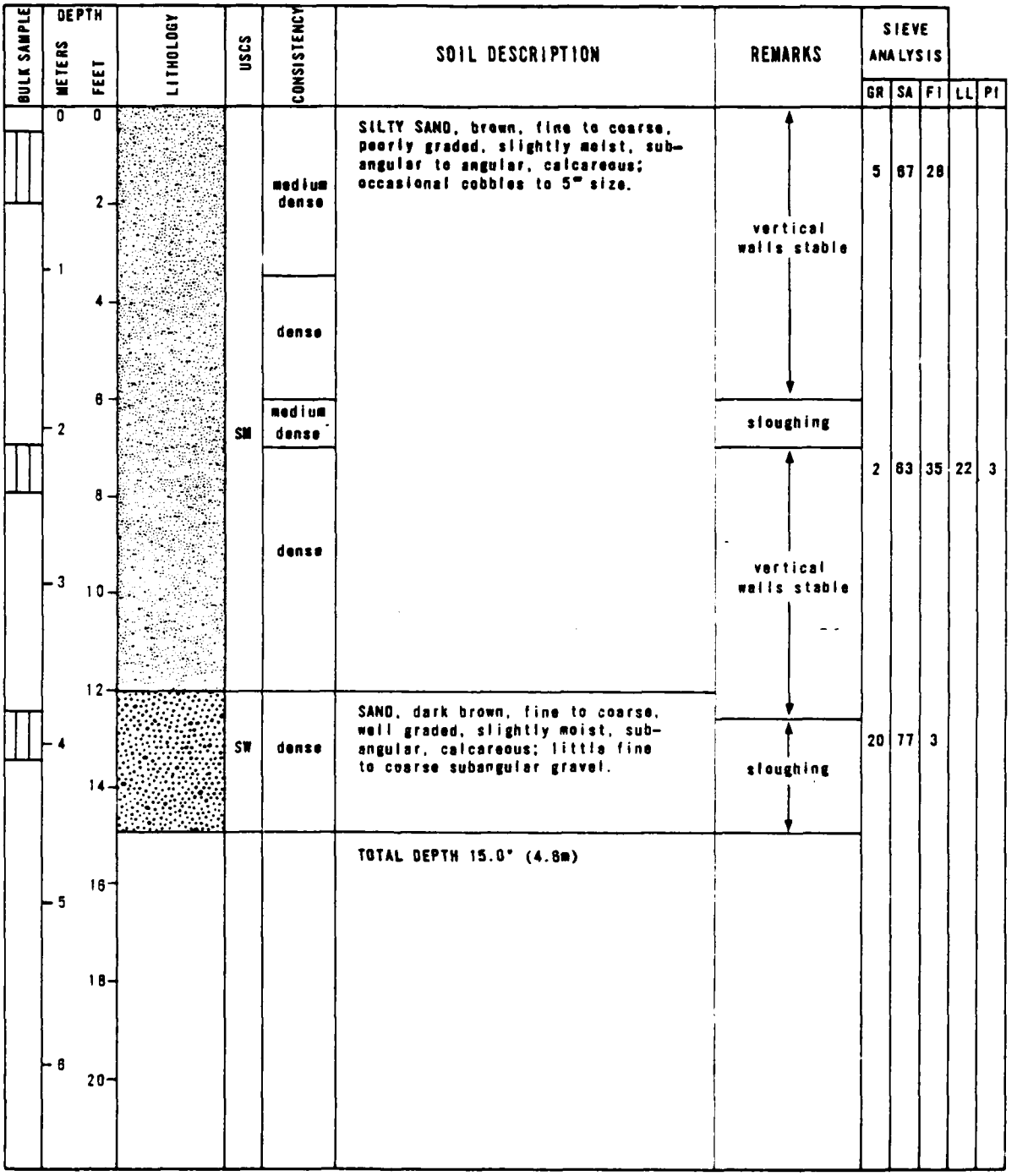
2 JUL 78

AFV-04

FN-TR-27-11



TRENCH DETAILS

SURFACE ELEVATION	: 5275' (1608m)
DATE EXCAVATED	: 21 OCTOBER 1978
SURFICIAL GEOLOGIC UNIT	: A5i
TRENCH LENGTH	: 15.0' (4.8m)
TRENCH ORIENTATION	: NE - SW

LOG OF TRENCH WW-T-4
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 7-4

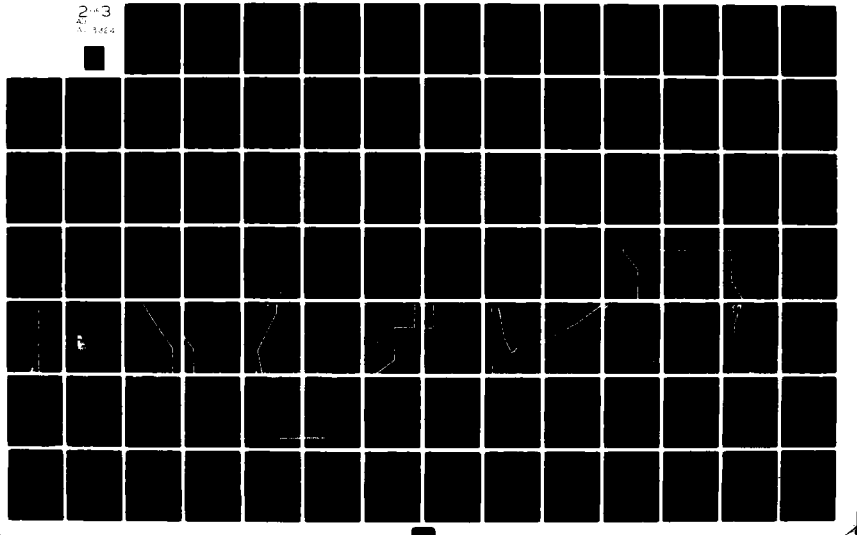
FUGRO NATIONAL, INC.

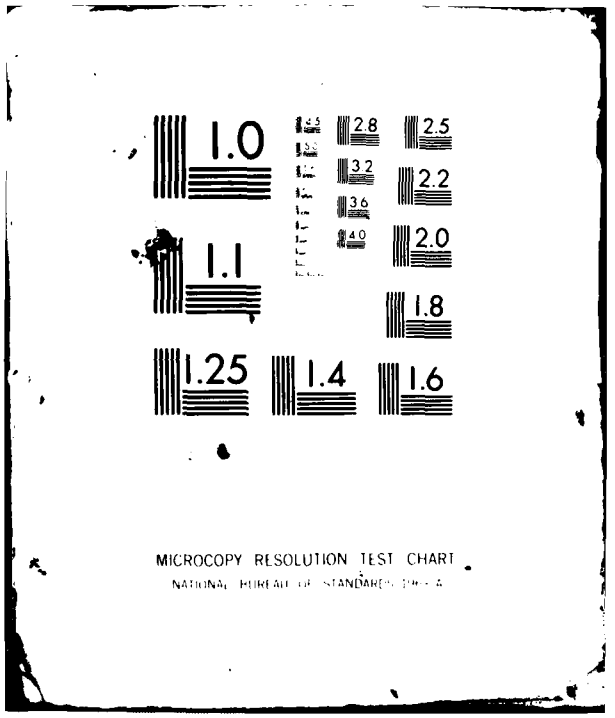
CHECKED BY _____ APPROVED BY _____

2 JUL 79

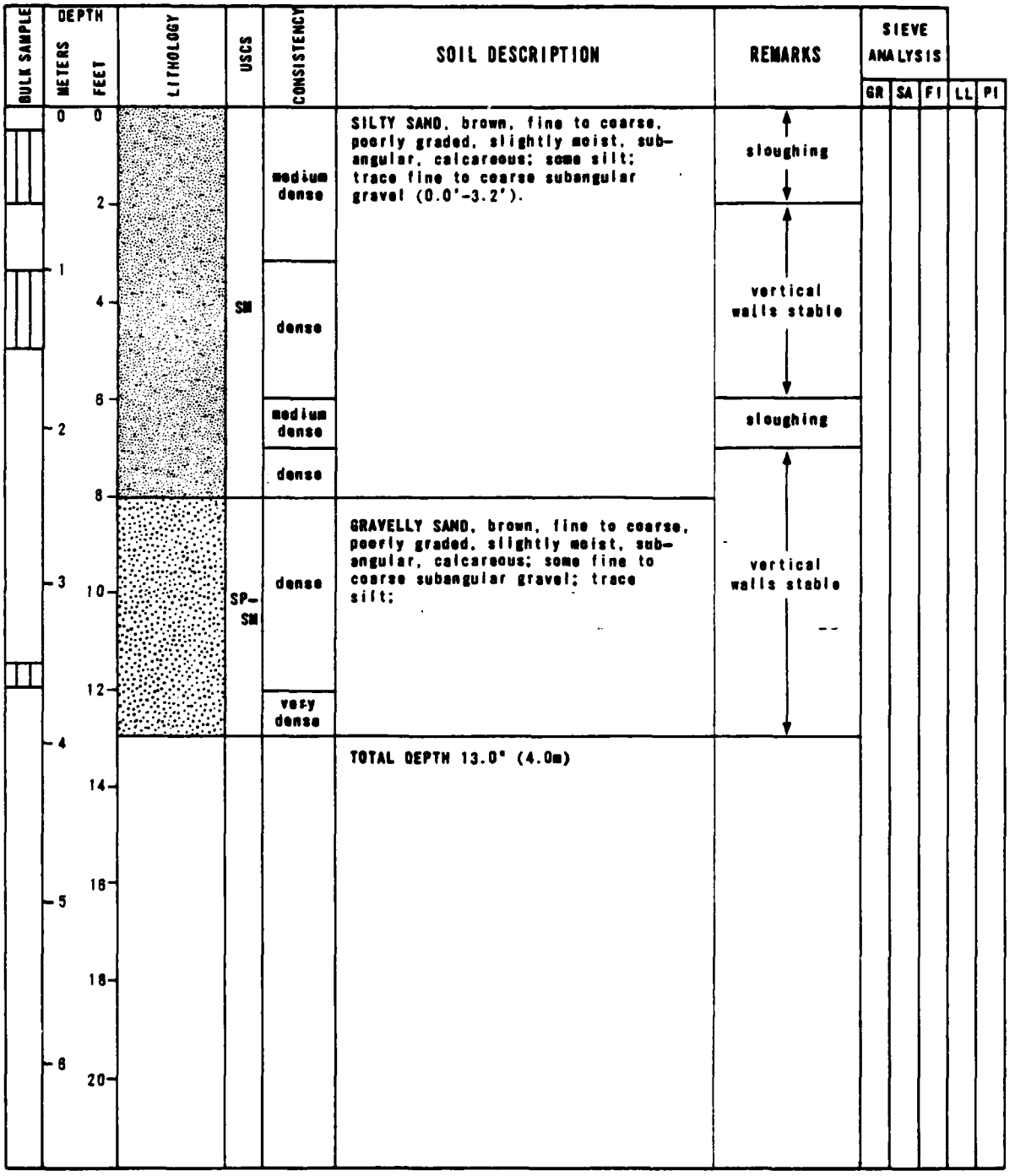
AFV-04

AD-A113 324 FUGRO NATIONAL INC LONG BEACH CA F/G 8/13
MX SITING INVESTIGATION. GEOTECHNICAL EVALUATION. VOLUME II. NE--ETC(U)
AUG 79 F04704-78-C-0027
UNCLASSIFIED FN-TR-27-VOL-2 NL




1.0
1.1
1.25
1.4
1.6
1.8
2.0
2.2
2.5
2.8
3.2
3.6
4.0
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963-A

FN-TR-27-11



TRENCH DETAILS

SURFACE ELEVATION : 5028' (1532m)
DATE EXCAVATED : 22 OCTOBER 1978
SURFICIAL GEOLOGIC UNIT : A5y/A4e
TRENCH LENGTH : 14.0' (4.3m)
TRENCH ORIENTATION : E - W

LOG OF TRENCH WW-T-5
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 7-5

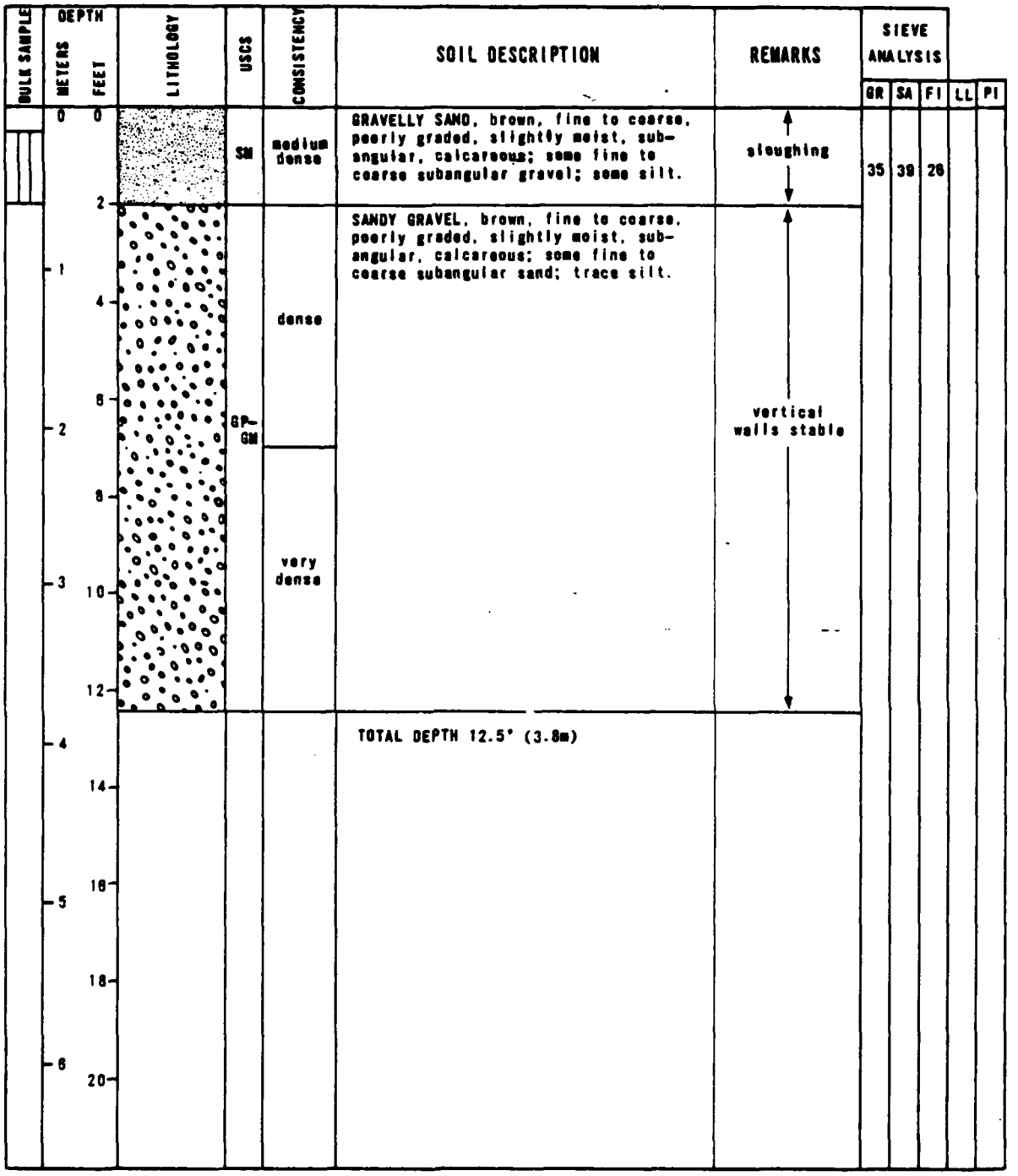
FUGRO NATIONAL, INC.

CHECKED BY _____ APPROVED BY _____

2 JUL 79

AFV-04

FN-TR-27-11



TRENCH DETAILS

SURFACE ELEVATION	:	5058' (1542m)
DATE EXCAVATED	:	23 OCTOBER 1978
SURFICIAL GEOLOGIC UNIT	:	A5y/A4o
TRENCH LENGTH	:	13.5' (4.1m)
TRENCH ORIENTATION	:	NW - SE

LOG OF TRENCH WW-T-6
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 7-6

FUGRO NATIONAL, INC.

CHECKED BY _____ APPROVED BY _____

2 JUL 79

AFV-04

FN-TR-27-11

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		CL	stiff	SILTY CLAY, brown, slightly moist, slightly plastic, calcareous; some fine to coarse sand.						
	1			SM	very dense	GRAVELLY SAND, brown, fine to coarse, poorly graded, subangular, calcareous; some fine to coarse subangular gravel; little silt; stage I caliche.		38	46	16		
	2											
		1										
	3											
	4											
	5					TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 5148' (1569m)
SURFICIAL GEOLOGIC UNIT: ASi

LOG OF TEST PIT WW-P-1

	0	0		CL	very stiff	SILTY CLAY, brown, slightly moist, slightly plastic, calcareous; little fine to coarse sand; trace fine to coarse gravel, stage I-II caliche (1.2'-2.2').						
	1											
	2			SM	very dense	GRAVELLY SAND, brown, fine to coarse, poorly graded, calcareous; some fine to coarse gravel; trace cobbles to 4" size; stage I caliche.						
	3											
		1										
	4					TOTAL DEPTH 4.0' (1.2m)						
	5											

SURFACE ELEVATION: 5380' (1640m)
SURFICIAL GEOLOGIC UNIT: ASi

LOG OF TEST PIT WW-P-2

CHECKED BY _____ APPROVED BY _____

LOGS OF TEST PITS WW-P-1 AND WW-P-2
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 7-7

FUGRO NATIONAL, INC.

2 JUL 79

AFV-03

LOG OF TEST PIT WW-P-3

SURFACE ELEVATION: 6420' (1852m)
SURFICIAL GEOLOGIC UNIT: A5I

Depth (feet)	USCS	Consistency	Soil Description	Remarks	GR	SA	FI	LL	PI
0–2	SM	dense	GRAVELLY SAND, brown, fine to coarse, poorly graded, subangular, calcareous; some fine to coarse subangular gravel; little silt; occasional cobbles to 7" size.		37	42	21		
2–4	SM	very dense							
4			TOTAL DEPTH 4.0' (1.2m)						

LOG OF TEST PIT WW-P-4

SURFACE ELEVATION: 5500' (1676m)
SURFICIAL GEOLOGIC UNIT: A5I

Depth (feet)	USCS	Consistency	Soil Description	Remarks	GR	SA	FI	LL	PI
0–2	SM-SC	medium dense	SILTY SAND - CLAYEY SAND, brown, fine to coarse, poorly graded, subangular calcareous; some slightly plastic silt; little fine to coarse subangular gravel; stage I caliche.		15	40	45	31	8
2–4.5	SM	dense	GRAVELLY SAND, brown, fine to coarse, poorly graded, subangular, calcareous; fine to coarse, subangular gravel; little silt; occasional cobbles to 8" size; stage I caliche.						
4.5			TOTAL DEPTH 4.5' (1.4m)						

LOGS OF TEST PITS WW-P-3 AND WW-P-4
VERIFICATION SITE, WHIRLWIND CDP, UTAH

FIGURE 7-8

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FUGRO NATIONAL, INC.

CHECKED BY ________ APPROVED BY ________

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		CL	stiff	*SANDY CLAY, brown, slightly moist, slightly plastic, calcareous; some fine to coarse sand; little fine to coarse subangular gravel; stage I caliche.*						
	1	2		SM	dense	GRAVELLY SAND, brown, fine to coarse, poorly graded, subangular, calcareous; some fine to coarse subangular gravel; little silt; occasional cobbles to 6" size; stage I caliche.						
	1	3										
		4										
		5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 5787' (1764m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT WW-P-5

	0	0		SP	medium dense	*GRAVELLY SAND, gray, fine to coarse, poorly graded, angular, calcareous; some fine to coarse angular gravel; weathered tuff (2.5'-3.0').*						
	1	2			dense							
		3				TOTAL DEPTH 3.0' (0.9m)	encountered rock at 3.0'					
	1	4										
		5										

SURFACE ELEVATION: 4953' (1510m)
SURFICIAL GEOLOGIC UNIT: A5y

LOG OF TEST PIT WW-P-6

CHECKED BY _____ APPROVED BY _____

LOGS OF TEST PITS WW-P-5 AND WW-P-6
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 7-9

FUGRO NATIONAL, INC.

2 JUL 79

AFV-03

FN-TR-27-11

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0										
		1		CL	hard	SILTY CLAY, brown, dry, slightly plastic, calcareous; trace fine sand.						
		2										
	1	3		GM	dense	SILTY GRAVEL, brown, fine to coarse, poorly graded, subangular, calcareous; little fine to coarse sand; little silt.						
		4										
		5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 4911' (1497m)
SURFICIAL GEOLOGIC UNIT: A4e

LOG OF TEST PIT WW-P-7

0 0
1
2
3
1
4
5

SURFACE ELEVATION:
SURFICIAL GEOLOGIC UNIT:

LOG OF TEST PIT

CHECKED BY _____ APPROVED BY _____

LOG OF TEST PIT WW-P-7
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

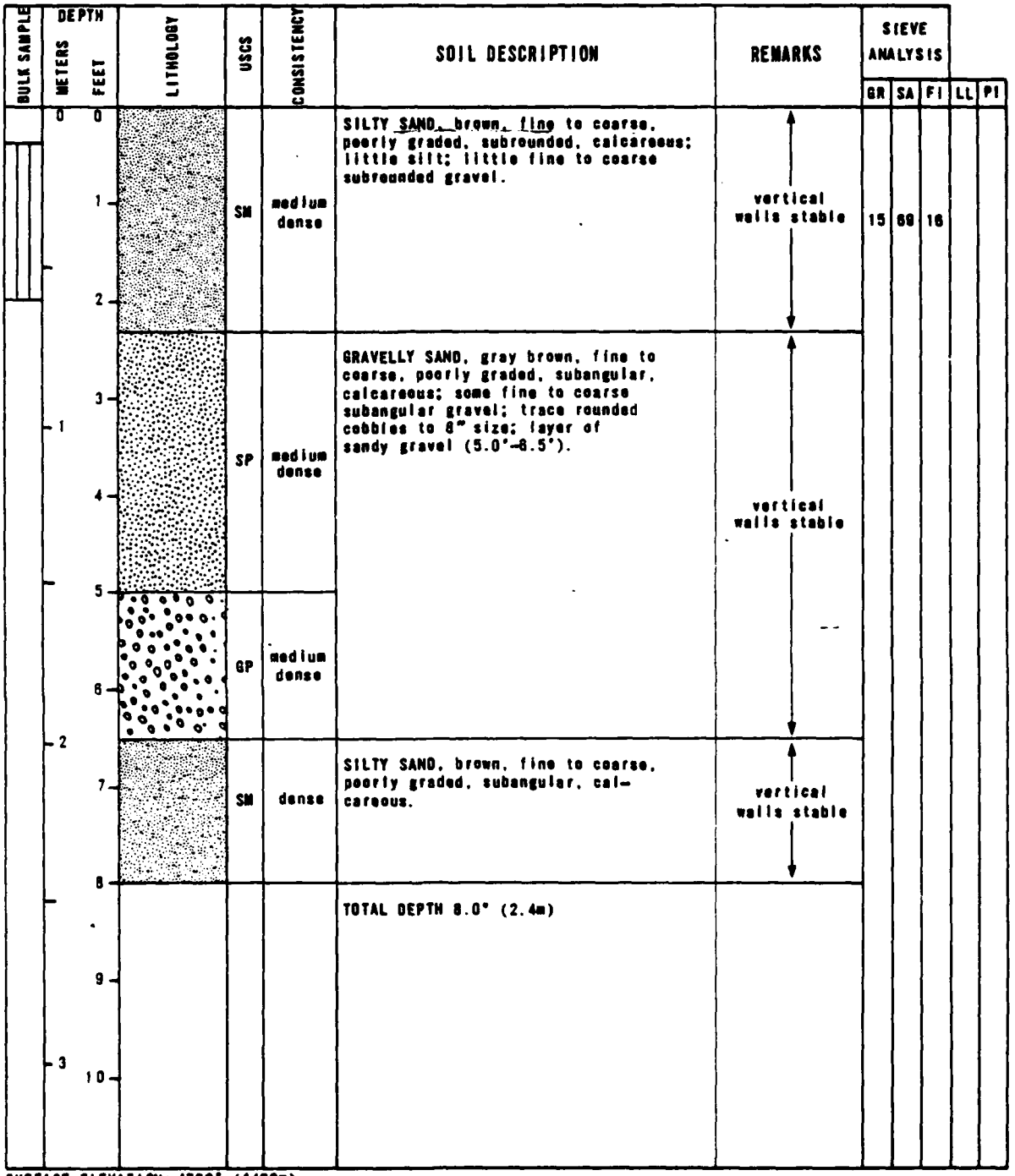
FIGURE 7-10

FUGRO NATIONAL, INC.

2 JUL 79

AFV-03

FN-TR-27-11



SURFACE ELEVATION: 4790' (1460m)
SURFICIAL GEOLOGIC UNIT: A4e/A5y

LOG OF TEST PIT WW-P-8

CHECKED BY _____ APPROVED BY _____

LOG OF TEST PIT WW-P-8
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

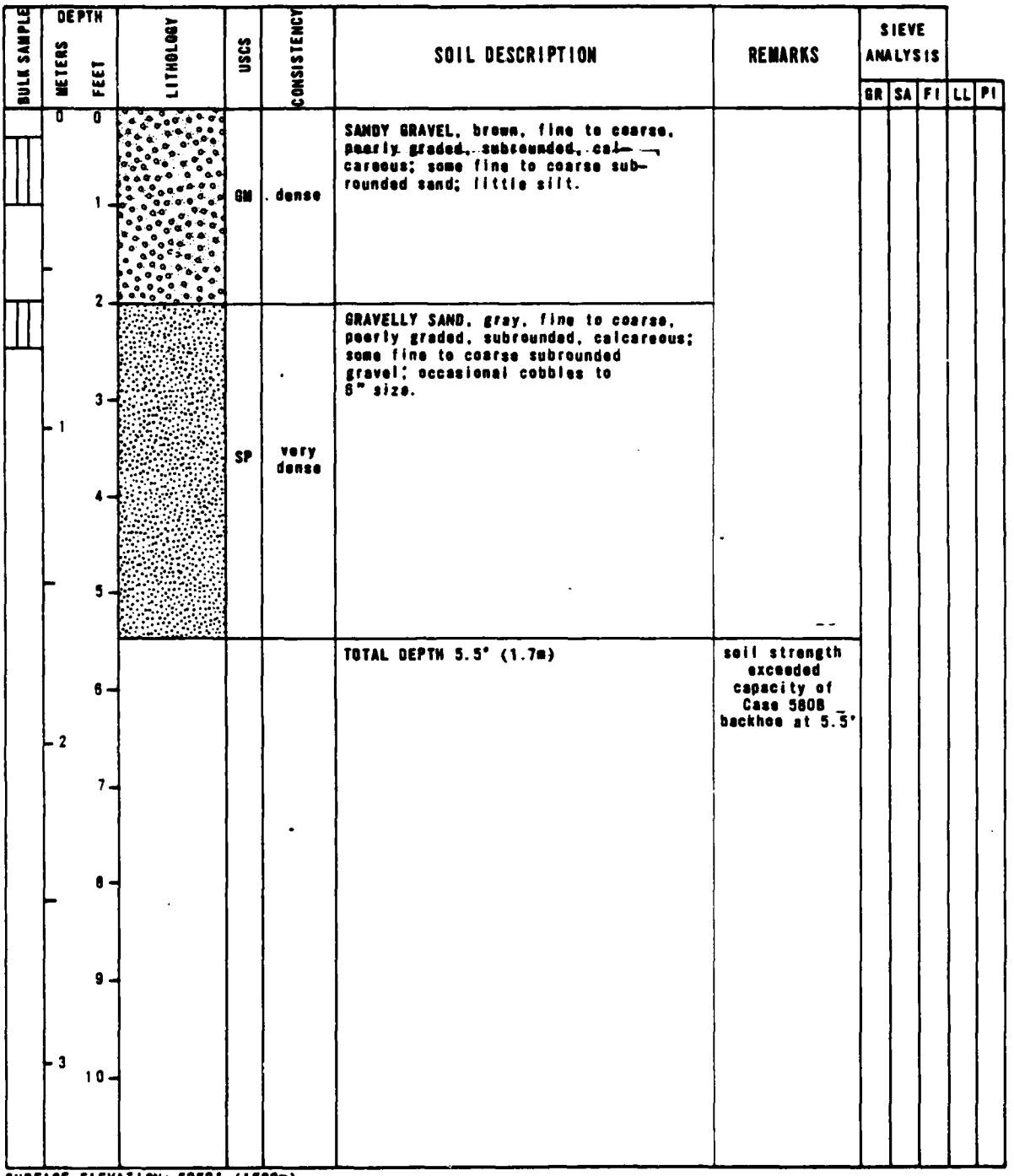
FIGURE 7-11

FUGRO NATIONAL, INC.

2 JUL 79

AFV-05

FN-TR-27-11



SURFACE ELEVATION: 5050' (1539m)
SURFICIAL GEOLOGIC UNIT: A5f(A4e)

LOG OF TEST PIT WW-P-8

CHECKED BY _____ APPROVED BY _____

LOG OF TEST PIT WW-P-8
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
7-12

UGRO NATIONAL, INC.

2 JUL 78

AFV-05

FN-TR-27-11

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0										
				GC	medium dense	CLAYEY GRAVEL, brown, fine to coarse, poorly graded, subrounded, calcareous; some slightly plastic clay; some fine to coarse subrounded sand; occasional cobbles to 8" size; stage I caliche.		40	27	33	35	12
		1										
		2			very dense							
		3										
	1					TOTAL DEPTH 3.0' (0.9m)	cementation and soil strength exceeded capacity of Case 580B backhoe at 3.0'					
		4										
		5										

SURFACE ELEVATION: 5218' (1590m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT WW-P-10

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS
	0	0					
		1				SILTY SAND, brown, fine to coarse, poorly graded, slightly moist, calcareous; some silt; trace fine to coarse gravel.	
		2		SM	medium dense		
		3					
	1						
		4					
		5				TOTAL DEPTH 5.0' (1.5m)	

SURFACE ELEVATION: 5148' (1569m)
SURFICIAL GEOLOGIC UNIT: A5y/A4e

LOG OF TEST PIT WW-P-11

CHECKED BY _____ APPROVED BY _____

LOGS OF TEST PITS WW-P-10 AND WW-P-11
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
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FIGURE 7-13

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2 JUL 79

AFV-03

FN-TR-27-11

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		CL	stiff	SANDY CLAY, brown, slightly plastic calcareous; some fine to coarse sand; trace fine to coarse gravel.				60	32	11
		1										
		2		GP	dense	SANDY GRAVEL, gray brown, fine to coarse, poorly graded, subrounded, calcareous; some medium to coarse sand; stage I caliche.						
		3				TOTAL DEPTH 3.0' (0.9m)	cementation and soil strength exceeded capacity of Case 580B backhoe at 3.0'					
	1	4										
		5										

SURFACE ELEVATION: 5152' (1570m)
SURFICIAL GEOLOGIC UNIT: A4e

LOG OF TEST PIT WW-P-12

	0	0		CL	stiff	SANDY CLAY, brown, slightly plastic, calcareous; some fine to coarse sand; trace fine to coarse gravel; stage I caliche.						
		1		GP	dense	SANDY GRAVEL, gray brown, fine to coarse, poorly graded, subrounded, calcareous; some medium to coarse sand; stage II caliche						
		2										
		3			very dense							
	1	4				TOTAL DEPTH 3.5' (1.1m)	cementation and soil strength exceeded capacity of Case 580B backhoe at 3.5'					
		5										

SURFACE ELEVATION: 5240' (1597m)
SURFICIAL GEOLOGIC UNIT: A5y

LOG OF TEST PIT WW-P-13

CHECKED BY _____ APPROVED BY _____

LOGS OF TEST PITS WW-P-12 AND WW-P-13
VERIFICATION SITE, WHIRLWIND CDP, UTAH

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FIGURE 7-14

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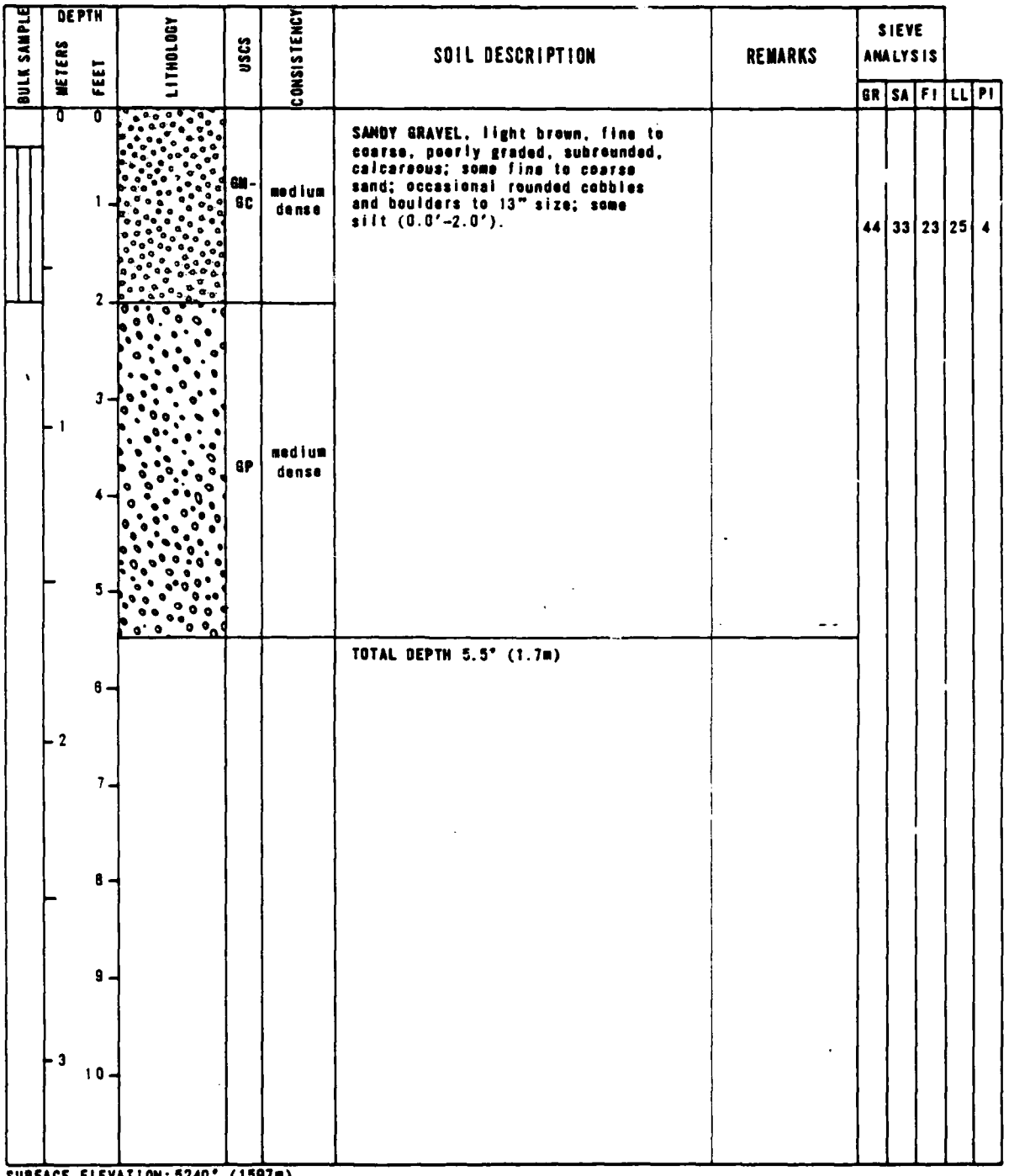
FN-TR-27-11



SURFACE ELEVATION: 5240' (1597m)
SURFICIAL GEOLOGIC UNIT: Asy

LOG OF TEST PIT WW-P-14

CHECKED BY _____ APPROVED BY _____

LOG OF TEST PIT WW-P-14
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
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FIGURE
7-15

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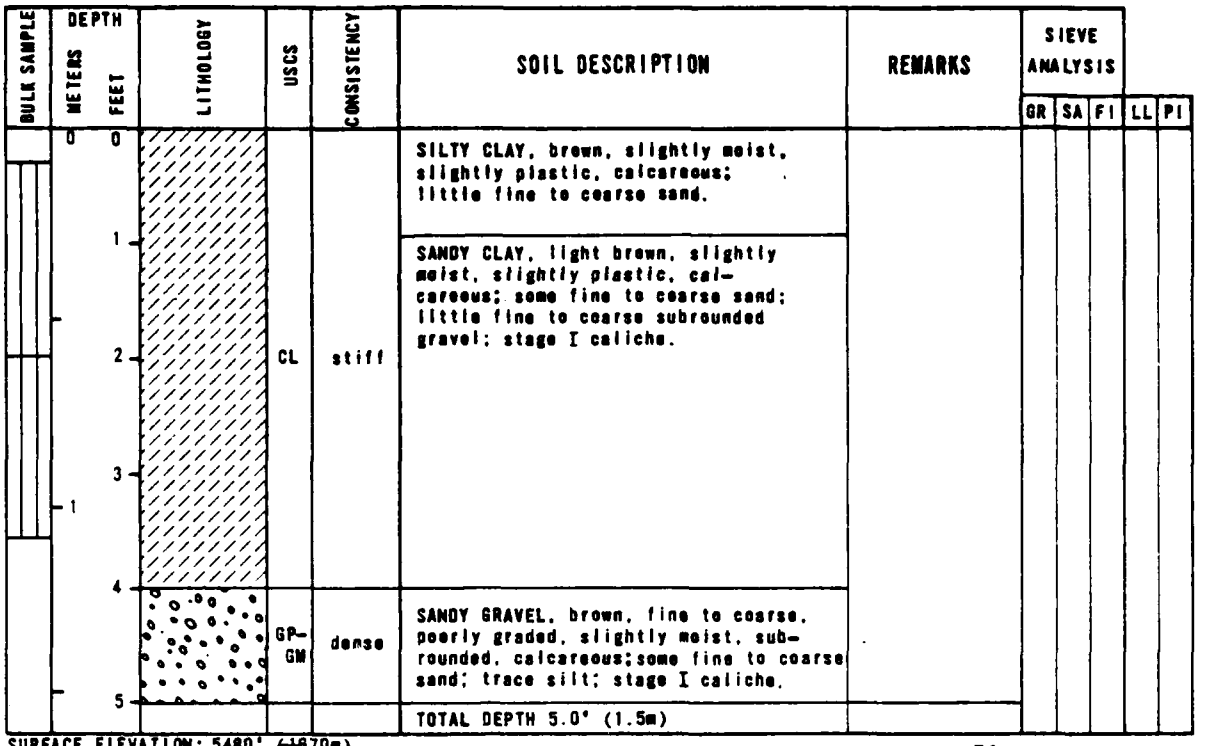
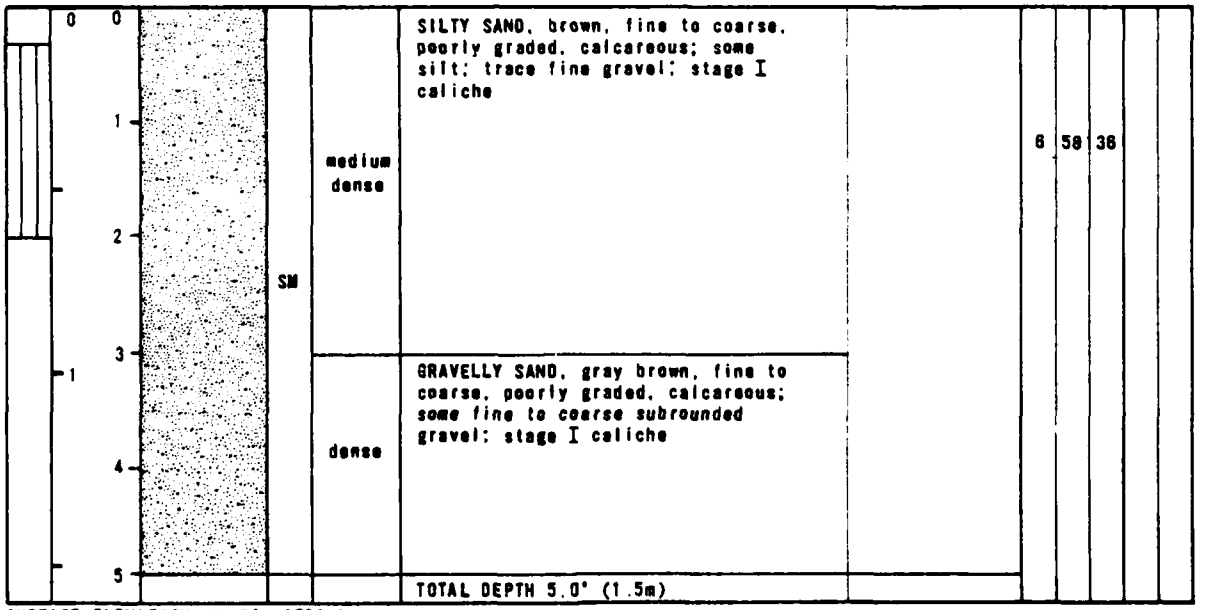
FN-TR-27-11



SURFACE ELEVATION: 5480' (~1670m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT WW-P-15



SURFACE ELEVATION: 5147' (~1588m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o

LOG OF TEST PIT WW-P-16

CHECKED BY ____ APPROVED BY ____

LOGS OF TEST PITS WW-P-15 AND WW-P-16
VERIFICATION SITE, WHIRLWIND COP, UTAH

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FIGURE 7-16

FUGRO NATIONAL, INC.

2 JUL 79

AFV-03

FN-TR-27-11

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM	medium dense	SILTY SAND, brown, fine to coarse, poorly graded, calcareous; some silt; little fine to coarse subrounded gravel; stage I caliche.						
	1			GM	dense	SANDY GRAVEL, gray brown, fine to coarse, poorly graded, subrounded, calcareous; some fine to coarse sand; occasional subrounded cobbles; stage II caliche						
	2			SM	dense	SILTY SAND, gray black, fine to coarse, poorly graded, calcareous; some silt; little fine gravel.						
	3	1										
	4											
	5					TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 5248' (1600m)
SURFICIAL GEOLOGIC UNIT: A5e

LOG OF TEST PIT WW-P-17

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM	medium dense	SILTY SAND, brown, fine to coarse, poorly graded, calcareous; little silt; little fine to coarse subrounded gravel; occasional cobbles to 12" size.		13	69	18		
	1											
	2											
	3	1										
	4											
	5					TOTAL DEPTH 4.5' (1.4m)						

SURFACE ELEVATION: 5317' (1621m)
SURFICIAL GEOLOGIC UNIT: A5e

LOG OF TEST PIT WW-P-18

CHECKED BY ____ APPROVED BY ____

LOGS OF TEST PITS WW-P-17 AND WW-P-18
VERIFICATION SITE, WHIRLWIND CDP, UTAH

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FIGURE 7-17

FUGRO NATIONAL, INC.

2 JUL 79

AFV-03

FN-TR-27-11

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM–SC	medium dense	SILTY SAND – CLAYEY SAND, brown, fine to coarse, poorly graded, calcareous; some slightly plastic silt; trace fine subrounded gravel.						
		1										
		2		GM	very dense	SANDY GRAVEL, light brown, fine to coarse, poorly graded, subrounded, calcareous; some medium to coarse sand; stage I caliche.						
	1	3										
		4				TOTAL DEPTH 4.0' (1.2m)						
		5										

SURFACE ELEVATION: 5080' (1548m)
SURFICIAL GEOLOGIC UNIT: Qsy/A4e

LOG OF TEST PIT WW-P-19

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SC	dense	CLAYEY SAND, light brown, fine to coarse, calcareous; some slightly plastic clay; little gravel; stage I caliche.						
		1		GP	very dense	SANDY GRAVEL, light brown, fine to coarse, poorly graded, subrounded to rounded, calcareous; occasional cobbles to 12" size; stage II caliche						
		2										
	1	3				TOTAL DEPTH 2.5' (0.8m)	soil strength exceeded capacity of Case 580B backhoe at 2.5'					
		4										
		5										

SURFACE ELEVATION: 5273' (1607m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT WW-P-20

CHECKED BY _____ APPROVED BY _____

LOGS OF TEST PITS WW-P-19 AND WW-P-20
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
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FIGURE 7-18

FUGRO NATIONAL, INC.

2 JUL 79

AFV-03

FN-TR-27-11

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		ML	firm	SANDY SILT, brown, slightly plastic, calcareous; some fine to coarse sand; stage I caliche.				63	50	15
		1										
		2		GP	very dense	SANDY GRAVEL, light brown, fine to coarse, poorly graded, subrounded, calcareous; occasional cobbles and boulders to 18" size; stage IV caliche.						
		3										
	1					TOTAL DEPTH 3.0' (0.9m)	soil strength and cementation exceeded capacity of Case 580B backhoe at 3.0'					
		4										
		5										

SURFACE ELEVATION: 5840' (1719m)
SURFICIAL GEOLOGIC UNIT: A5e

LOG OF TEST PIT WW-P-21

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM-SC	medium dense	SILTY SAND - CLAYEY SAND, brown, fine to coarse, poorly graded, sub-rounded, calcareous; some slightly plastic silt; little fine rounded gravel.		17	59	24	38	13
		1										
		2		GM	dense	SANDY GRAVEL, light brown, fine to coarse, poorly graded, subrounded, calcareous; some medium to coarse sand; trace silt; occasional cobbles and boulders; stage I caliche.						
		3										
	1											
		4										
		5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 5440' (1658m)
SURFICIAL GEOLOGIC UNIT: A5y

LOG OF TEST PIT WW-P-22

CHECKED BY____ APPROVED BY____

LOGS OF TEST PITS WW-P-21 AND WW-P-22
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 7-19

FUGRO NATIONAL, INC.

2 JUL 79

AFV-03

FN-TR-27-11

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0			medium dense	SILTY SAND, brown, fine to coarse, poorly graded, subrounded, calcareous; some silt; little fine rounded gravel; stage I caliche						
	1			SM		GRAVELLY SAND, light brown, fine to coarse, poorly graded, subrounded, calcareous; some fine to coarse rounded gravel; stage I caliche.						
	2				dense							
	3	1										
	4											
	5					TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 5896' (1797m)
SURFICIAL GEOLOGIC UNIT: A5i

LOG OF TEST PIT WW-P-23

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0				SILTY SAND, brown, fine to coarse, poorly graded, subrounded, calcareous; some fine to coarse subrounded gravel.						
	1											
	2			SM	medium dense	GRAVELLY SAND, light brown, fine to coarse, poorly graded, subrounded calcareous; some fine to coarse gravel.						
	3	1										
	4											
	5					TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 4893' (1491m)
SURFICIAL GEOLOGIC UNIT: A5y/A4e

LOG OF TEST PIT WW-P-24

CHECKED BY____ APPROVED BY____

LOGS OF TEST PITS WW-P-23 AND WW-P-24
VERIFICATION SITE, WHIRLWIND COP, UTAH

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FIGURE 7-20

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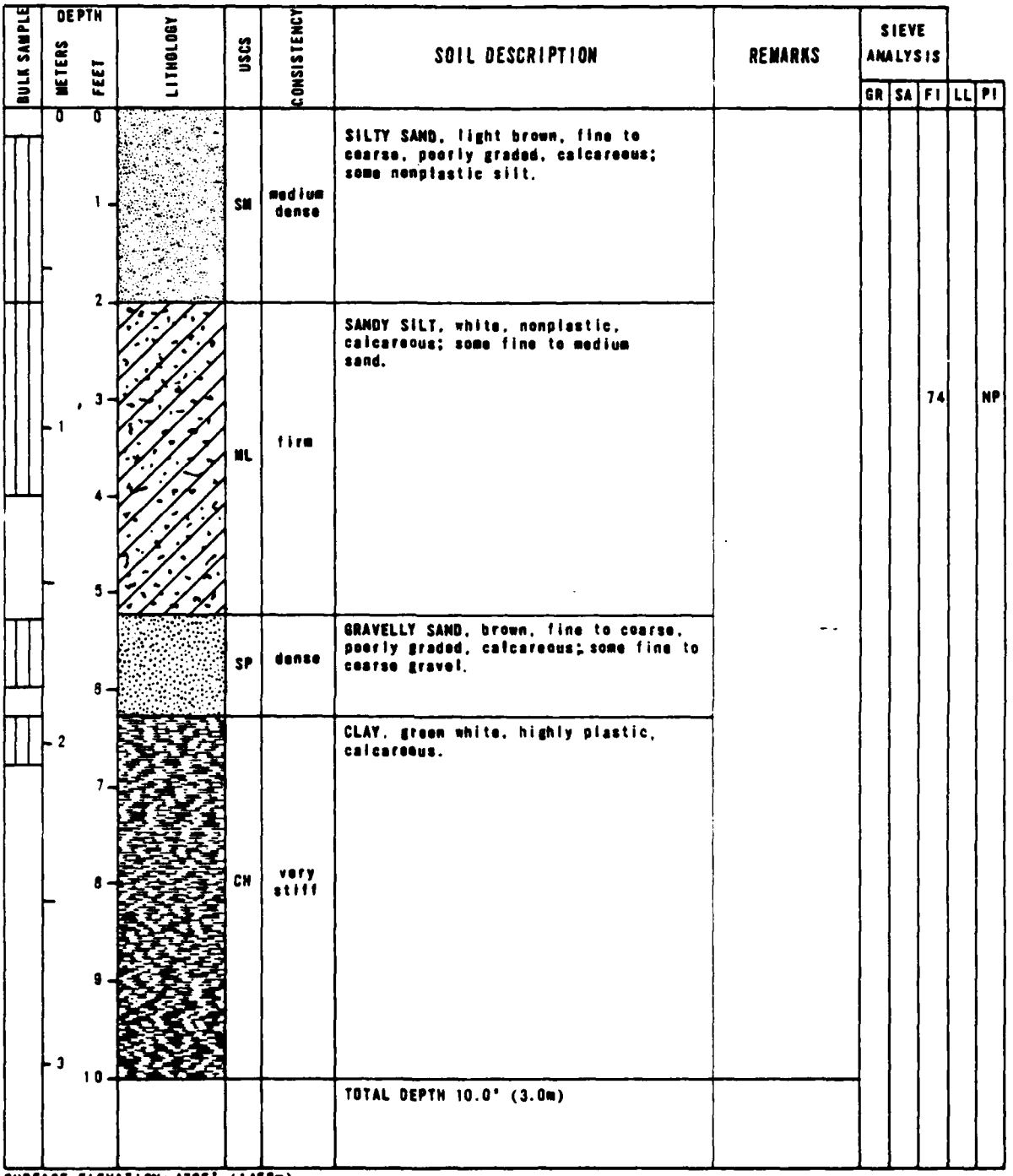
2 JUL 78

AFV-03

FN-TR-27-11



SURFACE ELEVATION: 4785' (1458m)
SURFICIAL GEOLOGIC UNIT: A5y, A4e

LOG OF TEST PIT WW-P-25

CHECKED BY _____ APPROVED BY _____

LOG OF TEST PIT WW-P-25.
VERIFICATION SITE, WHIRLWIND CDP, UTAH

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DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE
7-21

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2 JUL 78

AFV-05

FN-TR-27-11

BULK SAMPLE	DEPTH METERS	DEPTH FEET	LITHOLOGY	USCS	CONSISTENCY	SOIL DESCRIPTION	REMARKS	SIEVE ANALYSIS GR	SA	FI	LL	PI
	0	0		SM	medium dense	SILTY SAND, light brown, fine to coarse, poorly graded, slightly moist, calcareous; little slightly plastic silt; trace fine to coarse subrounded gravel; occasional cobbles to 6" size.						
		1										
	1	2										
		3										
		4										
		5				TOTAL DEPTH 5.0' (1.5m)						

SURFACE ELEVATION: 4920' (1500m)
SURFICIAL GEOLOGIC UNIT: A5y/A4es

LOG OF TEST PIT WW-P-26

	0	0										
		1										
	1	2										
		3										
		4										
		5										

SURFACE ELEVATION:
SURFICIAL GEOLOGIC UNIT:

LOG OF TEST PIT

CHECKED BY _____ APPROVED BY _____

LOG OF TEST PIT WW-P-26
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
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FIGURE 7-22

FUGRO NATIONAL, INC.

2 JUL 78

AFV-03

SECTION 8.0

SURFICIAL SAMPLE LOGS

EXPLANATIONS OF SURFICIAL SAMPLE LOGS

Finalized logs of the surficial samples are presented in this section. The explanations provided here are to serve as general guidelines to reading the logs.

A. Designations - Surficial samples are identified as follows:

SE-CS-1

SE - abbreviation for the site (e.g., SE - Snake East)
CS - abbreviation for surficial sample
1 - number of activity

B. Ground Surface Elevation - Indicated elevations on the logs are estimated from topographic maps of the study area within an accuracy of half the contour interval.

C. Surficial Geologic Unit - Indicates the surficial geologic unit in which the activity is located.

D. Depth - Indicates depth interval for which soil description is given.

E. USCS - Unified Soil Classification Symbol; see Table 6-1 of Section 6.0, "Boring Logs", for details of USCS.

F. Soil Description - Soil is described based on field visual descriptions and/or laboratory test results. See Section 6.0, "Boring Logs", for procedures of soil description.

G. Sieve Analysis, LL and PI - These are from results of laboratory tests. See Section 6.0, "Boring Logs", for explanation.

ACTIVITY NUMBER	GROUND SURFACE ELEVATION, FEET (METERS)	SURFICIAL GEOLOGIC UNIT	DEPTH, FEET (METERS)	USCS	SOIL DESCRIPTION	SIEVE ANALYSIS				
						GR	SA	FI	LL	PI
VW-CS-1	4723 (1440)	A4e	0.0-4.0 (0.0-1.2)	SM	SILTY SAND, light brown to green, fine to medium, poorly graded, calcareous; some silt.					
VW-CS-3	4840 (1475)	A4e	0.0-2.0 (0.0-0.6)	CL	SILTY CLAY, light brown, slightly plastic, calcareous; trace fine sand.					
VW-CS-7	5100 (1554)	A4e	0.0-2.0 (0.0-0.6)	SM	SILTY SAND, brown, fine to coarse, poorly graded; little silt; trace fine gravel.					
VW-CS-9	5212 (1589)	A5i	0.0-1.5 (0.0-0.5)	CL	SILTY CLAY, light brown, slightly plastic, calcareous; little fine sand; trace fine gravel.					
VW-CS-11	5340 (1628)	A5i	0.0-2.0 (0.0-0.6)	CL	SILTY CLAY, light brown, slightly plastic, calcareous; little fine to medium sand.					
VW-CS-19	5100 (1554)	A5y/A4e	0.0-2.0 (0.0-0.6)	ML	SANDY SILT, light brown, nonplastic, calcareous.			97	25	3
VW-CS-21	5213 (1589)	A5i	0.0-2.0 (0.0-0.6)	SP	SAND, light brown, fine to coarse, poorly graded, calcareous; trace silt; trace fine gravel.					
VW-CS-23	5300 (1615)	A5e	0.0-1.0 (0.0-0.3)	SC	CLAYEY SAND, brown, fine to coarse, poorly graded, calcareous; some slightly plastic clay; little fine gravel.	19	58	23		
			1.0-2.0 (0.3-0.8)	GP	SANDY GRAVEL, light brown, fine, poorly graded, subangular to subrounded, calcareous; some fine to coarse sand.					
VW-CS-24	5380 (1634)	A5e	0.0-2.0 (0.0-0.6)	SC	CLAYEY SAND, light brown, fine to coarse, poorly graded, calcareous; some slightly plastic clay; trace fine gravel.					
VW-CS-28	5291 (1613)	A5i	0.0-2.0 (0.0-0.6)	GM	SANDY GRAVEL, light brown, fine to coarse, poorly graded, subrounded, calcareous; some fine to coarse sand; occasional cobbles; some silt.					

LOGS OF SURFICIAL SOIL SAMPLES
VERIFICATION SITE,
WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
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FIGURE 8-1 1 OF 3

UGRO NATIONAL, INC.

ACTIVITY NUMBER	GROUND SURFACE ELEVATION, FEET (METERS)	SURFICIAL GEOLOGIC UNIT	DEPTH, FEET (METERS)	USCS	SOIL DESCRIPTION	SIEVE ANALYSIS GR	SA	FI	LL	PI
VW-CS-27	5340 (1628)	A5i	0.0-1.0 (0.0-0.3)	CL	SILTY CLAY, brown, slightly plastic, calcareous; trace fine sand; trace fine gravel.					
			1.0-2.0 (0.3-0.6)	GP	GRAVEL, light brown, fine to coarse, poorly graded, subrounded, calcareous; trace sand.					
VW-CS-37	5120 (1561)	A5y/A4e	0.0-2.0 (0.0-0.6)	SM	SILTY SAND, brown, fine to coarse, poorly graded, subangular, calcareous; some silt; trace fine to coarse gravel.					
VW-CS-44	4980 (1518)	A1/A4e	0.0-2.0 (0.0-0.6)	CL	SANDY CLAY, light brown, slightly plastic, calcareous; some fine sand.					
VW-CS-45	5090 (1551)	A5y/A4e	0.0-1.5 (0.0-0.5)	SC	CLAYEY SAND, light brown, fine to coarse, poorly graded, calcareous; some slightly plastic clay; little fine to coarse gravel.	17	41	42		
			1.5-2.0 (0.5-0.6)	GP	GRAVEL, white, fine to coarse, poorly graded, subrounded, calcareous; trace sand; trace silt.					
VW-CS-48	5153 (1571)	A5y/A4e	0.0-1.0 (0.0-0.3)	SM	SILTY SAND, light brown, fine, poorly graded, calcareous; some silt.					
			1.0-2.0 (0.3-0.6)	SC	CLAYEY SAND, light brown, fine, poorly graded, subrounded, calcareous; some slightly plastic clay; trace fine gravel.					
VW-CS-51	4970 (1515)	A5y/A4e	0.0-2.0 (0.0-0.6)	ML	SANDY SILT, light brown, nonplastic, calcareous; some fine sand.	0	40	60		
VW-CS-53	4895 (1492)	A5y/A4e	0.0-2.0 (0.0-0.6)	SM	SILTY SAND, light brown, fine to medium, poorly graded, calcareous; some silt; trace fine to coarse gravel.					
VW-CS-58	5653 (1723)	A5i	0.0-1.0 (0.0-0.3)	SM	GRAVELLY SAND, light brown, fine to coarse, poorly graded, calcareous; some fine to coarse gravel; some silt.					
			1.0-2.0 (0.3-0.6)	GP	GRAVEL, light brown, fine to coarse, poorly graded, subrounded, calcareous; little fine to coarse sand; trace silt.					

LOGS OF SURFICIAL SOIL SAMPLES
VERIFICATION SITE,
WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 8-1
2 OF 3

FUGRO NATIONAL, INC.

ACTIVITY NUMBER	GROUND SURFACE ELEVATION, FEET (METERS)	SURFICIAL GEOLOGIC UNIT	DEPTH, FEET (METERS)	USCS	SOIL DESCRIPTION	SIEVE ANALYSIS GR	SA	FI	LL	PI
WW-CS-58	5293 (1613)	A5y	0.0-1.0 (0.0-0.3)	GC	SANDY GRAVEL, light brown, fine to coarse, poorly graded, subrounded to subangular, calcareous; some fine to coarse sand; some slightly plastic clay.	41	36	23		
			1.0-2.0 (0.3-0.6)	GP	GRAVEL, light brown, fine to coarse, poorly graded, calcareous; little fine to coarse sand; trace silt.					
WW-CS-60	4883 (1488)	A5y/A4a	0.0-2.0 (0.0-0.6)	SM	SILTY SAND, light brown, fine to coarse, poorly graded, calcareous; some silt; some fine to coarse gravel.					
WW-CS-61	4892 (1491)	A5y/A4a	0.0-2.0 (0.0-0.6)	SM	SILTY SAND, brown, fine to coarse, poorly graded, subrounded, calcareous; some silt; little fine gravel.					
WW-CS-62	4850 (1478)	A5y/A4a	0.0-2.0 (0.0-0.6)	SM	SILTY SAND, brown, fine to coarse, poorly graded, calcareous; little to some silt; trace to some fine to coarse gravel; trace cobbles.					
WW-CS-64	4893 (1430)	A4a	0.0-1.0 (0.0-0.3)	CH	CLAY, brown, highly plastic, calcareous.					
			1.0-2.5 (0.3-0.8)	SM	SILTY SAND, white, fine, poorly graded, calcareous; some silt; little fine to coarse gravel.					
WW-CS-65	4850 (1417)	A4a	0.0-1.0 (0.0-0.3)	CL	SILTY CLAY, brown, slightly plastic, calcareous; trace fine sand.					
			1.0-2.0 (0.3-0.6)	GM	SANDY GRAVEL, brown, fine to coarse, poorly graded, calcareous; some fine to coarse sand.					
WW-CS-66	4543 (1385)	A4a	0.0-1.0 (0.0-0.3)	SC	CLAYEY SAND, brown, fine to coarse, poorly graded, calcareous; some slightly plastic clay.	4	62	34		
			1.0-2.0 (0.3-0.6)	SP	GRAVELLY SAND, brown, fine to coarse, poorly graded, calcareous; some fine gravel.					

LOGS OF SURFICIAL SOIL SAMPLES
VERIFICATION SITE,
WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 8-1 3 OF 3

FUGRO NATIONAL, INC.

SECTION 9.0

LABORATORY TEST RESULTS

EXPLANATIONS OF LABORATORY TEST RESULTS

Laboratory test results are presented in this section. Table 9-1 contains a summary of laboratory test results. This table contains results of sieve analysis; plasticity data; in-situ dry unit weight, moisture content, degree of saturation, and void ratio for drive and Pitcher samples; results of compaction tests; and specific gravity of solids. Other tests such as triaxial compression, unconfined compression, direct shear, consolidation, chemical, and California Bearing Ratio (CBR) are indicated on the table. Tables 9-2 through 9-6 and Figures 9-1 through 9-3 present results of triaxial compression, unconfined compression, direct shear, consolidation, chemical, and CBR tests.

All tests were performed in general accordance with the American Society for Testing and Materials (ASTM) procedures. The following table presents the ASTM designations for the tests performed during the investigation.

Type of Test	ASTM Designations
Particle Size Analysis	D 422-63
Liquid Limit	D 423-66
Plastic Limit	D 424-59
Unit Weight	D 2937-71
Moisture Content	D 2216-71
Compaction	D 1557-70
Specific Gravity of Solids	D 854-58
Triaxial	D 2850-70
Unconfined Compression	D 2166-66
Direct Shear	D 3080-72
Consolidation	D 2435-70
Test for Alkalinity (pH)	D 1067-70
Water Soluble Sodium	D 1428-64
Water Soluble Chloride	D 512-67
Water Soluble Sulphate	D 516-68
Water Soluble Calcium	D 511-72
Calcium Carbonate	D 1126-67
California Bearing Ratio (CBR)	D 1883-73

Explanation for the tables and figures presented in this section are as follows.

A. Activity Number - Boring, trench, test pit, or surficial sample designation.

B. Sample Number - Prefix indicates the type of sample; explanation is at the bottom of the table.

C. Sample Interval - This is the depth range measured from ground surface over which the sample was obtained.

D. Percent Finer by Weight - Presents the results of laboratory particle size analysis (ASTM D 422-63) performed on representative soil samples at the depth indicated. The numbers represent the percent (by dry weight) of the total sample weight passing through each sieve size indicated.

E. Atterberg Limits (ASTM D 423-66 and D 424-59)

LL - Liquid Limit, the water content (as percent of soil dry weight) corresponding to the arbitrary limit between the liquid and plastic states of consistency of a soil (ASTM D 423-66).

PL - Plastic Limit, the water content corresponding to an arbitrary limit between the plastic and the semisolid state of consistency of a soil (ASTM D 424-59).

PI - Plasticity Index, numerical difference between the liquid limit (LL) and the plastic limit (PL) indicating the range of moisture content within which a soil-water mixture is plastic.

NP - Nonplastic.

F. USCS - Unified Soil Classification Symbols are given here; see Table 6.1 in Section 6.0, "Boring Logs", for complete details of USCS system.

G. In Situ - Presents results of tests on drive and Pitcher samples.

Dry Unit Weight - indicates dry unit weight of soil determined as per ASTM D 2937-71

Moisture Content - weight of water reported in percent of dry weight of soil sample (ASTM D 2216-71)

Saturation - the degree of saturation in a soil sample is defined as the ratio (in percent) of the volume of water to the volume of all voids in the soil

Void Ratio - the numerical ratio of the volume of voids to the volume of solids in a soil specimen

H. Compacted - Indicates results of laboratory maximum dry density and optimum moisture content test as per ASTM D 1557-70.

I. Specific Gravity of Solids (ASTM D 854-58) - Indicates the ratio of (1) the weight in air of a given volume of soil solids at a stated temperature, to (2) the weight in air of an equal volume of distilled water at a stated temperature.

J. Triaxial - The triaxial compression tests were performed in accordance with the procedures of ASTM D 2850-70. The following explanations and definitions apply.

Triaxial Compression Test - a cylindrical specimen of soil is surrounded by a fluid in a pressure chamber and subjected to an isotropic pressure. An additional compressive load is then applied, directed along the axis of the specimen called the axial load.

Consolidated-Drained (CD) Test - a triaxial compression test in which the soil was first consolidated under an all-around confining stress (test chamber pressure), and was then compressed (and hence sheared) by increasing the

vertical stress. Drained indicates that excess pore water pressure generated by strains are permitted to dissipate by the free movement of pore water during consolidation and compression.

Consolidated-Undrained (CU) Test - a triaxial compression test in which essentially complete consolidation under the confining (chamber) pressure is followed by a shear test at constant water content.

Confining Pressure (σ_3) - the isotropic chamber pressure applied to the soil specimen during consolidation and compression.

Maximum Deviator Stress ($\sigma_1 - \sigma_3$) - the difference between the major and minor principal stresses in the specimen at failure. The major principal stress on the specimen is equal to the unit axial load plus the chamber pressure and the minor principal stress on the specimen is equal to the chamber pressure.

Strain Rate - axial strain, ε, at a given stress level is defined as the ratio of the change in length (ΔL) of the specimen to the original length of the specimen (L_o). The rate of strain was controlled during the test so that this ratio increased at equal increments for each minute of testing.

Back Pressure - pressure in excess of atmospheric applied to the pore water of a soil sample. Back pressure is usually applied to (1) increase saturation of the sample, or (2) simulate the actual in-situ pressure regime.

K. Unconfined Compression - Test procedures were as described in ASTM D 2166-66. Unconfined compressive strength is defined as the load per unit area at which an unconfined prismatic or cylindrical specimen of soil will fail in a simple compression test. In these methods, unconfined compressive strength is taken as the maximum load attained per unit area or the load per unit area at 20 percent axial strain, whichever occurred first during the performance of a test.

L. Direct Shear - The procedures of ASTM D 3080-72 were followed for direct shear testing. In this test, soil under an applied normal load is stressed to failure by moving one section of the soil container (shear box) relative to the other section. Normal stress is the value of load per unit area acting perpendicular to the plane of shearing. Maximum shear strength is defined as the maximum resistance (ksf) of a soil to shearing (tangential) stresses.

M. Consolidation (ASTM D 2435-70) - A consolidation test is a test in which a cylindrical soil specimen is laterally confined in a ring and compressed between porous plates. The term "consolidation", as used here, indicates the gradual reduction in volume of the soil mass resulting from an increase in compressive stress (axial load per unit area).

N. Chemical - The chemical tests performed on soil samples included: pH; water soluble sodium, chloride, sulphate, calcium; and calcium carbonate content. pH is an index of the acidity or alkalinity of a soil in terms of the logarithm of the reciprocal of the hydrogen ion concentration. ASTM test procedure designations for these chemical tests are included in the table at the beginning of the "Explanation of Laboratory Test Results".

O. CBR - California Bearing Ratio (CBR) is the ratio (in percent) of the resistance to penetration developed by a subgrade soil to that developed by a standard crushed-rock

base material. The procedures for conducting a CBR test were as outlined in ASTM D 1883-73. The materials tested for CBR were also analyzed for particle size distribution (ASTM D 422-63) and compaction characteristics (ASTM D 1557-70). The term "percentage of maximum density" indicates the ratio (as a percentage) of the compacted sample dry unit weight to maximum dry density obtained in the laboratory from ASTM D 1557-70, "Moisture-Density Relations of Soils Using 10-pound (4.5 kg) Hammer and 18-inch (457 mm) Drop".

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER							
				STANDARD SIEVE OPENING							
				BLDRS	COBBLES		GRAVEL				
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	
WW-B-1	D-1	0.9-1.4	0.27-0.43						100	74	6
	P-2	2.5-3.3	0.76-1.01						100	85	6
	P-2	4.1-4.9	1.25-1.49								
	P-3	7.3-7.7	2.23-2.35								
	D-4	10.4-11.2	3.17-3.41								
WW-B-2	D-2	3.6-4.3	1.10-1.31				100	74	74	62	3
	D-3	6.6-7.3	2.01-2.23						100	98	9
	D-4	8.8-9.5	2.68-2.90								
	D-5	15.2-15.9	4.63-4.85					100	86	81	7
	D-6	20.0-20.7	6.10-6.31					100	88	80	9
	P-7	25.0-25.4	7.62-7.74								
	D-9	26.0-26.7	7.92-8.14								
	D-11	40.1-40.8	12.22-12.44								
	D-12	50.6-51.3	15.42-15.64							100	9
	D-13	65.0-65.3	19.81-19.90								
	D-14	80.4-80.9	24.51-24.66						100	95	
	D-15	95.2-95.4	29.02-29.08								
	P-16	119.5-120.1	36.42-36.61								
	D-17	140.5-141.1	42.82-43.01						100	92	
	D-18	159.5-159.9	48.62-48.74								
WW-B-3	D-1	0.5-1.2	0.15-0.37							100	
	D-2	3.1-3.8	0.94-1.16							100	
	D-3	6.7-7.4	2.04-2.26							100	
	P-5	9.0-9.5	2.74-2.90								
	D-6	11.6-12.3	3.54-3.75								
	D-7	15.6-16.3	4.75-4.97						100	96	
	D-10	30.7-31.2	9.36-9.51								
	D-11	40.3-40.8	12.28-12.44								
	D-12	50.3-50.8	15.33-15.48						100	96	
	D-13	65.2-65.7	19.87-20.03								
	D-14	80.2-80.7	24.44-24.60								
	D-15	100.3-100.8	30.57-30.72					100	99	84	
	D-16	120.3-120.8	36.67-36.82								
	D-17	140.3-140.8	42.76-42.92							100	
	D-19	159.5-159.8	48.62-48.71								
WW-B-4	P-1	1.6-2.3	0.49-0.70					100	90	80	
	D-2	3.2-3.9	0.98-1.19							100	
	D-3	6.6-7.3	2.01-2.23							100	
	D-4	9.1-9.8	2.77-2.99								
	D-5	15.2-15.9	4.63-4.85					100	94	90	

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

CHECKED BY _____ APPROVED BY _____

ER BY WEIGHT												IN-SITU					COMPACTED			
U S STANDARD SIEVE NO						PARTICLE SIZE (mm)		ATTERBERG LIMITS (b)			USCS (c)	DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS
SAND				SILT OR CLAY																
"	4	10	40	100	200	.005	.001	LL	PL	PI		(pcf)	(kg/m³)				(pcf)	(kg m³)		
	60	50	43	33	27						GM	102.2	1637	3.2	13.5	0.65				
	62	42	26	15	12						SP-SM			3.3						
			100	99	88						ML									
		100	99	99	92						ML	98.8	1583	16.0	61.2	0.71				
											SM		1873	4.9	30.3	0.44				
	36	23	16	13	11						GP-GM	121.2	1941	2.3	15.7	0.39				
	84	49	22	15	13						SM	117.8	1887	2.9	17.9	0.43				
											SM	114.3	1831	4.5	25.7	0.47				
	71	56	38	26	22						SC	112.0	1794	9.1	48.8	0.50				
	54	36	25	17	13						GM	132.1	2116	6.5	63.8	0.28				
											SM	117.3	1879	12.9	80.2	0.44				
											SM	133.5	2138	9.0	92.8	0.26				
											SM	134.5	2154	6.9	74.6	0.25				
	96	66	21	15	13						SC	123.6	1980	9.7	72.6	0.36				
											SM	124.1	1988	8.8	66.5	0.36				
	71	53	36	27	22						SM	130.8	2095	5.3	49.5	0.29				
											SM	129.3	2071	6.7	60.3	0.30				
											SC			10.2						
	84	62	32	21	18						SM	132.6	2124	9.8	97.6	0.27				
											SM	123.2	1973	10.8	79.2	0.37				
	99	95	72	49	39						SM	105.7	1693	13.1	59.4	0.59				
	97	77	35	18	13						SM	101.3	1623	6.8	27.9	0.66				
	96	69	21	12	10						SP-SM	116.9	1873	5.4	32.9	0.44				
											SP-SM	100.9	1616	8.7	35.3	0.67				
											SW-SM	111.4	1784	5.3	27.9	0.51				
	73	55	27	15	12						SW-SM	118.7	1901	9.5	61.4	0.42				
											SM	114.2	1829	11.5	65.5	0.48				
											SP	110.3	1773	15.8	80.7	0.53				
	89	74	42	23	16						SM	118.3	1895	10.3	65.1	0.42				
											SP	116.7	1869	8.9	53.9	0.44				
											SP-SM	124.4	1993	12.1	92.3	0.36				
	73	53	23	13	9						SW-SM	125.3	2007	8.6	67.2	0.34				
											SP	124.7	1998	8.3	63.6	0.35				
	99	85	39	22	14						SM	120.6	1932	9.0	61.1	0.40				
											SW	124.2	1989	13.7	100.0	0.36				
	68	47	18	7	4						SW	107.4	1720	3.6	17.0	0.57				
	99	87	36	18	13						SM	104.8	1679	7.0	31.0	0.61				
	99	80	31	19	15						SM	110.4	1768	6.4	32.9	0.53				
	100	89	49	33	22						SM	110.2	1765	7.0	35.8	0.53				
	79	58	24	15	13						SM	118.5	1898	11.1	71.1	0.42				

1

2

VOID RATIO	COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
	MAXIMUM DRY DENSITY (pcf)	MAXIMUM DRY DENSITY (kg m³)	OPTIMUM MOISTURE (%)							
0.65										
0.71										
0.44										
0.39										
0.43										
0.47										
0.50										
0.28							*			
0.44										
0.26										
0.25										
0.36										
0.36										
0.29										
0.30										
0.27										
0.37										
0.59										
0.66										
0.44										
0.67										
0.51										
0.42										
0.48										
0.53										
0.42										
0.44										
0.36										
0.34										
0.35										
0.40										
0.36										
0.57										
0.61										
0.53							*			
0.53										
0.42										

SUMMARY OF LABORATORY TEST RESULTS
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAMSO

TABLE 9-1 1 OF 4

FUGRO NATIONAL, INC.

AFW-01

35

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER B							
				STANDARD SIEVE OPENING							
				BLDRS.	COBBLES		GRAVEL				
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	4
WW-B-4	P-6	20.0-20.5	6.10-6.25								
	D-8	25.5-25.9	7.77-7.89								
	D-9	30.2-30.9	9.20-9.42						100	94	8
	D-10	40.1-40.8	12.22-12.44								
	D-11	50.1-50.4	15.27-15.36								
	D-12	60.0-60.3	18.29-18.38								
	P-14	71.0-72.0	21.64-21.95					100	95	86	8
	P-15	80.0-80.9	24.38-24.66								
	P-16	88.0-88.8	26.82-27.07								
	P-17	101.9-102.5	31.06-31.24								1
	P-18	118.0-118.8	35.97-36.21								1
	P-19	140.0-140.8	42.67-42.92								
	P-20	160.0-160.8	48.77-49.01								
WW-B-5	D-1	0.1-0.8	0.03-0.24					100	72	48	3
	D-2	5.5-6.2	1.68-1.89						100	85	7
	D-4	11.0-11.7	3.35-3.60								
	D-6	16.2-16.9	4.94-5.15							100	9
	D-7	21.3-21.9	6.49-6.68								
	D-8	26.3-26.9	8.02-8.20								
	D-9	31.9-32.6	9.72-9.94								
	D-10	40.5-40.9	12.34-12.47						100	79	5
	D-11	50.9-51.4	15.51-15.67					100	93	87	6
	D-12	65.4-65.9	19.93-20.09								
	D-13	80.4-80.9	24.51-24.66						100	96	8
	D-14	101.4-101.9	30.91-31.06								
	D-15	121.0-121.3	36.88-36.97								
	D-16	141.0-141.5	42.98-43.13						100	99	8
	D-17	161.0-161.4	49.07-49.19								
WW-B-6	D-1	0.9-1.2	0.27-0.37						100	73	5
	D-2	5.1-5.8	1.55-1.77					100	91	57	3
	D-3	8.2-8.8	2.50-2.68								
	D-4	15.5-15.8	4.72-4.82								
	D-5	21.2-21.9	6.46-6.68								
	D-6	26.1-26.8	7.96-8.17								1
	D-7	31.4-31.7	9.57-9.66						100	96	8
	D-8	45.6-45.9	13.90-13.99								
	D-9	55.4-55.9	16.89-17.04						100	98	9
	D-11	81.3-81.8	24.78-24.93					100	95	85	7
	D-12	91.4-91.9	27.86-28.01								
	D-13	101.2-101.6	30.85-30.97								
	D-14	121.0-121.2	36.88-36.94						100	88	

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

CHECKED BY _____ APPROVED BY _____

ER BY WEIGHT							ATTERBERG LIMITS (b)			USCS (c)	IN-SITU					COMPACTED			SPECIFIC GRAVITY OF SOLIDS
U S STANDARD SIEVE NO					PARTICLE SIZE (mm)						DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	
SAND				SILT OR CLAY															
4	10	40	100	200	.005	.001	LL	PL	PI		(pcf)	(kg/m³)				(pcf)	(kg m³)		
										SM									
										SM	116.1	1860	12.4	74.3	0.45				
86	71	48	41	38						SM	115.7	1853	11.0	64.8	0.45				
										SP-SM	110.7	1773	13.9	71.8	0.52				
										SP-SM	115.7	1853	15.1	89.2	0.46				
										SP-SM	120.2	1925	9.8	65.7	0.40				
81	63	22	15	12						SP-SM	115.3	1847	13.3	78.1	0.46				
										SM	124.8	1999	9.6	73.8	0.35				
										SM	105.8	1695	11.4	51.9	0.59				
100	98	73	20	10						SP-SM	122.5	1962	10.6	76.0	0.38				
100	97	90	84	74	16	6			NP	ML	101.7	1629	14.1	58.0	0.66				
										SM	107.4	1720	12.3	58.6	0.57				
										SM	117.5	1882	7.3	45.6	0.43				
36	32	29	27	25						GM	115.2	1845	5.0	29.3	0.46				
74	58	34	27	24						SM	103.6	1660	7.3	31.6	0.63				
										SM	121.1	1940	2.6	18.3	0.39				
98	97	95	92	86						CL	111.8	1791	4.0	21.3	0.51				
										SM	125.3	2007	8.4	65.6	0.34				
										SM	122.6	1964	6.8	49.3	0.38				
										SM	130.5	2090	8.0	74.6	0.29				
59	45	26	17	13						SM	129.9	2081	8.9	80.9	0.30				
68	50	34	27	22						SM	117.1	1876	9.8	60.2	0.44				
										SM	130.3	2087	7.6	70.0	0.29				
85	52	21	15	12						SP-SM	121.6	1948	12.4	86.8	0.39				
										SP-SM	135.4	2169	6.6	72.3	0.25				
										SM	139.6	2236	7.8	100.0	0.21				
85	53	32	25	20						SM	131.8	2111	8.0	78.0	0.28				
										SM	126.6	2028	5.4	43.8	0.33				
59	49	37	26	19						GM	103.4	1656	4.6	19.8	0.63				
39	27	16	9	7						GP-GM	112.0	1794	1.1	5.7	0.50				
										GM	126.3	2023	2.0	15.9	0.33				
										GM	131.7	2110	7.3	70.5	0.28				
										GM	122.6	1964	9.2	66.5	0.37				
100	99	88	61	38						SM	117.2	1877	12.5	77.2	0.44				
82	54	21	11	9						SW-SM	130.4	2089	7.9	73.8	0.29				
										SW-SM	136.5	2187	6.7	77.6	0.23				
93	79	39	14	9						SW-SM	119.9	1921	8.6	57.1	0.41				
74	65	47	31	20						SM	131.5	2106	4.5	43.3	0.28				
										SM	123.4	1977	8.6	63.7	0.37				
										SM	130.4	2089	6.9	64.3	0.29				
67	51	27	19	15						SM	129.5	2074	9.6	85.8	0.30				

TED								
(m³)	OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
							*	
							*	
							*	
							*	

SUMMARY OF LABORATORY TEST RESULTS, VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE 8-1
2 OF 4

FUGRO NATIONAL, INC.

AFV-01

3

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER BY WEIGHT								
				STANDARD SIEVE OPENING							U S STA	
				BLDRS.	COBBLES		GRAVEL					
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	4	10
WW-B-6	D-15	141.0-141.3	42.98-43.07					100	87	80	50	30
	b-16	145.4-145.6	44.32-44.38									
WW-T-1	B-1	0.0-2.0	0.00-0.61					100	93	80	65	53
	B-4	4.6-5.3	1.40-1.62									
WW-T-2	B-1	0.0-2.0	0.00-0.61				100	99	95	89	80	70
WW-T-3	B-1	0.4-2.0	0.12-0.61							100	99	95
	b-4	10.0-11.0	3.05-3.35									
WW-T-4	B-1	0.5-2.0	0.15-0.61						100	99	95	87
	b-2	7.0-8.0	2.13-2.44						100	99	98	94
	B-3	12.5-13.5	3.81-4.11					100	95	92	80	51
WW-T-6	B-1	0.5-2.0	0.15-0.61				100	94	89	77	65	55
WW-P-1	B-2	1.4-3.6	0.43-1.10					100	96	82	62	45
WW-P-3	B-1	0.3-1.3	0.09-0.40					100	98	82	63	47
WW-P-4	B-1	0.4-2.0	0.12-0.61						100	91	85	76
WW-P-8	B-1	0.4-2.0	0.12-0.61					100	98	91	85	80
WW-P-10	B-1	0.3-1.0	0.09-0.30				100	75	74	65	60	53
WW-P-12	B-1	0.3-1.5	0.09-0.46									
WW-P-14	B-1	0.4-2.0	0.12-0.61				100	94	84	66	56	48
WW-P-16	b-1	0.3-2.0	0.09-0.61							100	94	84
WW-P-18	B-1	0.3-2.0	0.09-0.61					100	96	93	87	75
WW-P-21	b-1	0.3-1.0	0.09-0.30									
WW-P-22	B-1	0.3-1.5	0.09-0.46						100	93	83	74
WW-P-24	B-1	0.3-1.5	0.09-0.46									
WW-P-25	B-2	2.0-4.0	0.61-1.22									

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

CHECKED BY _____ APPROVED BY _____

WEIGHT ·																				
S STANDARD SIEVE NO				PARTICLE SIZE (mm)		ATTERBERG LIMITS (b)			USCS (c)	IN-SITU					COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	
SAND			SILT OR CLAY							DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)			
10	40	100	200	.005	.001	LL	PL	PI		(pcf)	(kg/m³)				(pcf)	(kg m³)				
30	15	10	8						GP-GM	143.7	2302	8.9	100.0	0.17						
53	43	37	33						GM											
			82					NP	ML											
70	59	45	40					NP	SM						131.5	2106	9.1			
95	88	82	74	43	22	39	24	15	CL						115.0	1842	16.0			
									SP											
87	62	35	28						SM											
94	70	38	35	20	6	22	19	3	SM											
51	12	5	3						SW											
55	43	33	26						SM											
45	30	21	16						SM											
47	31	25	21						SM											
76	64	54	45			31	23	8	SM-SC											
80	58	25	16						SM						139.7	2238	7.0			
53	47	39	33			35	23	12	GC											
			60			32	21	11	CL											
48	38	29	23			25	21	4	GM-GC						139.5	2235	6.1			
84	67	47	36						SM											
75	51	25	18						SM											
			63			50	35	15	ML											
74	54	34	24			38	25	13	SM-SC											
									SM											
			74					NP	ML											

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COMPACTED			SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
MAXIMUM DRY DENSITY (pcf)	MAXIMUM DRY DENSITY (kg m³)	OPTIMUM MOISTURE (%)							
131.5	2106	9.1							*
115.0	1842	16.0						*	*
								*	
									*
139.7	2238	7.0							*
									*
139.5	2235	6.1							*
								*	
									*

.SUMMARY OF LABORATORY TEST RESULTS
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAMSO

TABLE 8-1
3 OF 4

FUGRO NATIONAL, INC.

AFV-0

3

ACTIVITY NUMBER	SAMPLE NUMBER (a)	SAMPLE INTERVAL		PERCENT FINER BY WEIGHT								
				STANDARD SIEVE OPENING							U S STA	
				BLDRS	COBBLES		GRAVEL					
		FEET	METERS	24"	12"	6"	3"	1½"	3/4"	3/8"	4	10
WW-P-26	B-1	0.1-1.8	0.03-0.55									
WW-CS-1	B-1	0.6-2.0	0.18-0.61									
WW-CS-19	B-1	0.4-2.0	0.12-0.61									
WW-CS-23	b-1	0.5-1.0	0.15-0.30						100	92	81	64
WW-CS-24	B-1	0.4-2.0	0.12-0.61									
WW-CS-45	B-1	0.3-1.3	0.91-0.40					100	89	87	83	78
WW-CS-51	b-1	0.3-1.0	0.09-0.30									100
WW-CS-58	B-1	0.3-1.0	0.09-0.30					100	83	71	59	49
WW-CS-65	b-1	0.3-1.0	0.09-0.30									
WW-CS-66	b-1	0.3-1.0	0.09-0.30							100	96	88

NOTES:

(a) Sample types
- SS - Standard split spoon
- P - Pitcher
- D - Fugro Drive
- B,b - Bulk

(b) NP - Not Plastic

(c) USCS - Unified Soil Classification System

(d) * Indicates that test has been performed and results are included in this report

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EIGHT										IN-SITU					COMPACTEI					
STANDARD SIEVE NO				PARTICLE SIZE (mm)		ATTERBERG LIMITS (b)			USCS (c)	DRY UNIT WEIGHT		MOISTURE CONTENT (%)	SATURATION (%)	VOID RATIO	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED
SAND			SILT OR CLAY							(pcf)	(kg/m³)				(pcf)	(kg m³)				
10	40	100	200	.005	.001	LL	PL	PI												
									SM											
									SM											
			97			25	22	3	ML											
64	40	28	23						SC											
									SC											
78	72	59	42						SC											
100	98	84	60						ML											
49	36	28	23						GC											
									CL											
88	78	51	34						SC											

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COMPACTED									
MAXIMUM DRY DENSITY (pcf)	MAXIMUM DRY DENSITY (kg m^3)	OPTIMUM MOISTURE (%)	SPECIFIC GRAVITY OF SOLIDS	TRIAXIAL (d)	UNCONFINED COMPRESSION	DIRECT SHEAR	CONSOLIDATION	CHEMICAL	CBR
									*
								*	
								*	
									*
									*
								*	

SUMMARY OF LABORATORY TEST RESULTS
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE SAMSO

TABLE 9-1
4 OF 4

FUGRO NATIONAL, INC.

BORING NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	NORMAL STRESS		MAXIMUM SHEAR STRENGTH	
		FEET	METERS		ksf	kN/m^2	ksf	kN/m^2
WW-B-2	D-6	20.0-20.7	6.10-6.31	GM	2.0	96	3.4	163
					3.0	144	4.0	192
WW-B-4	D-3	6.6-7.3	2.01-2.23	SM	0.6	29	0.8	38
					1.2	57	0.9	43
					1.8	86	1.5	72

CHECKED BY _____ APPROVED BY _____

SUMMARY OF DIRECT SHEAR TEST RESULTS
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE 9-2

FUGRO NATIONAL, INC.

CHECKED BY _____ APPROVED BY _____

2 JUL 79

ACTIVITY NO.	SAMPLE NO.	SAMPLE INTERVAL		SOIL TYPE	pH	WATER SOLUBLE				CALCIUM CARBONATE
		FEET	METERS			SODIUM	CHLORIDE	SULPHATE	CALCIUM	
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
WW-B-4	P-6	20.0-20.5	6.10-6.25	SM	7.1	322	284	88	431	145
	P-14	71.0-72.0	21.64-21.95	SP-SM	7.2	43	19	27	86	209
	P-18	118.0-118.8	35.97-36.21	ML	7.3	46	82	<11	80	259
	P-19	140.0-140.8	42.67-42.92	SM	7.4	43	19	<11	65	190
WW-T-3	B-1	0.4-2.0	0.12-0.61	CL	7.0	2098	1854	306	66	378
	b-4	10.0-11.0	3.05-3.35	SP	7.1	1576	1360	43	37	184
WW-P-21	b-1	0.3-1.0	0.09-0.30	ML	7.1	2688	2879	511	46	221
WW-CS-1	B-1	0.6-2.0	0.18-0.61	SM	7.2	914	1223	155	31	136
WW-CS-24	B-1	0.4-2.0	0.12-0.61	SC	7.1	75	930	52	59	225
WW-CS-65	b-1	0.3-1.0	0.09-0.30	CL	6.9	4124	3655	501	485	1820

SUMMARY OF CHEMICAL TEST RESULTS
VERIFICATION SITE, WHIRLWIND CDP, UTAH

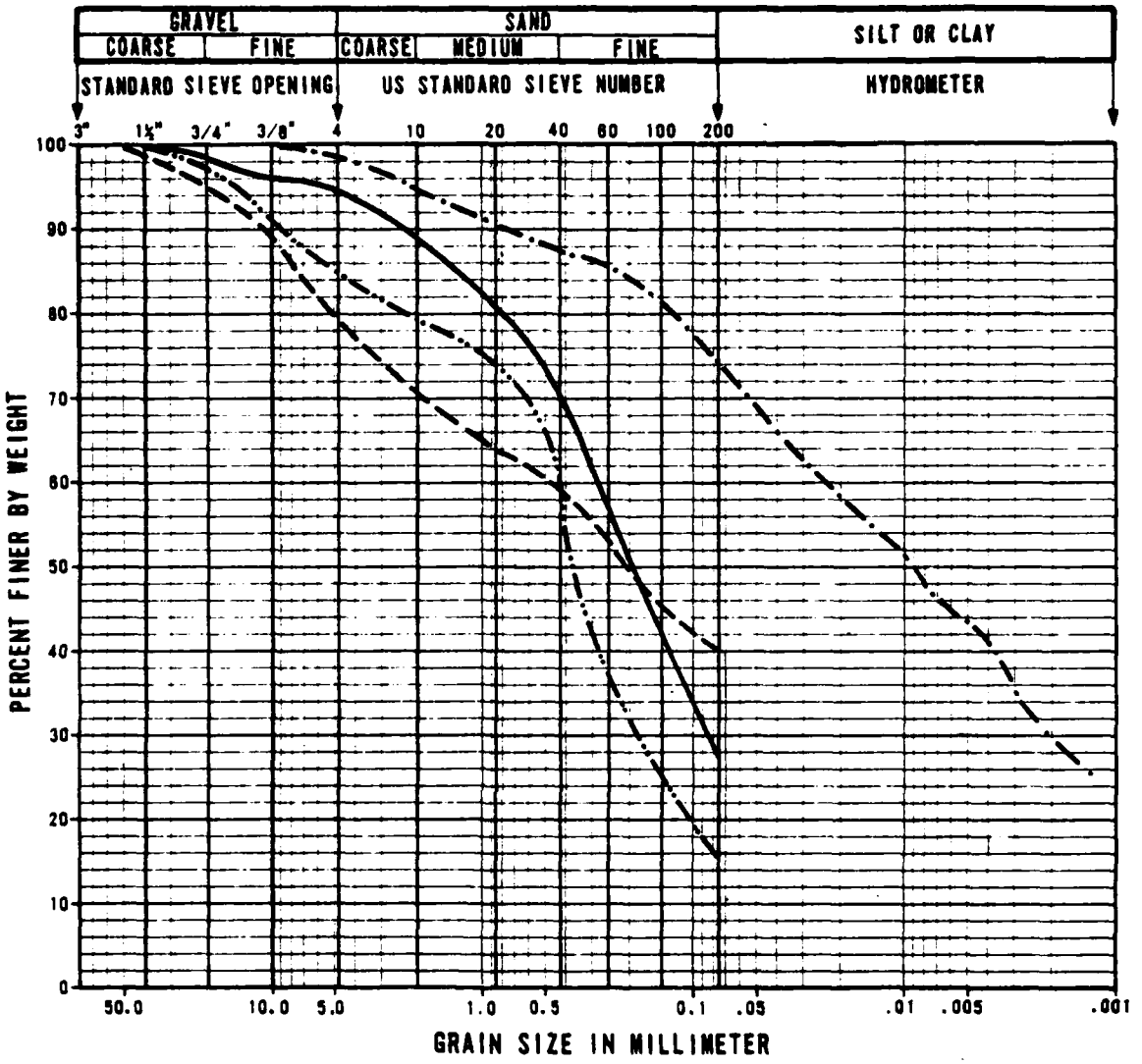
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE 9-3

UGRO NATIONAL, INC.

AFV-07

FN-TR-27-11



SYMBOL	COMPOSITE SAMPLE NUMBER	ACTIVITY NUMBER	SAMPLE INTERVAL		SOIL TYPE
			FEET	METERS	
———	A	WW-P-24	0.3-1.5	0.09-0.46	SM
		WW-P-26	0.1-1.8	0.03-0.55	
— — —	B	WW-T-2	0.0-2.0	0.00-0.61	SM
—·—	C	WW-T-3	0.4-2.0	0.12-0.61	CL
—··—	D	WW-P-8	0.4-2.0	0.12-0.61	SM

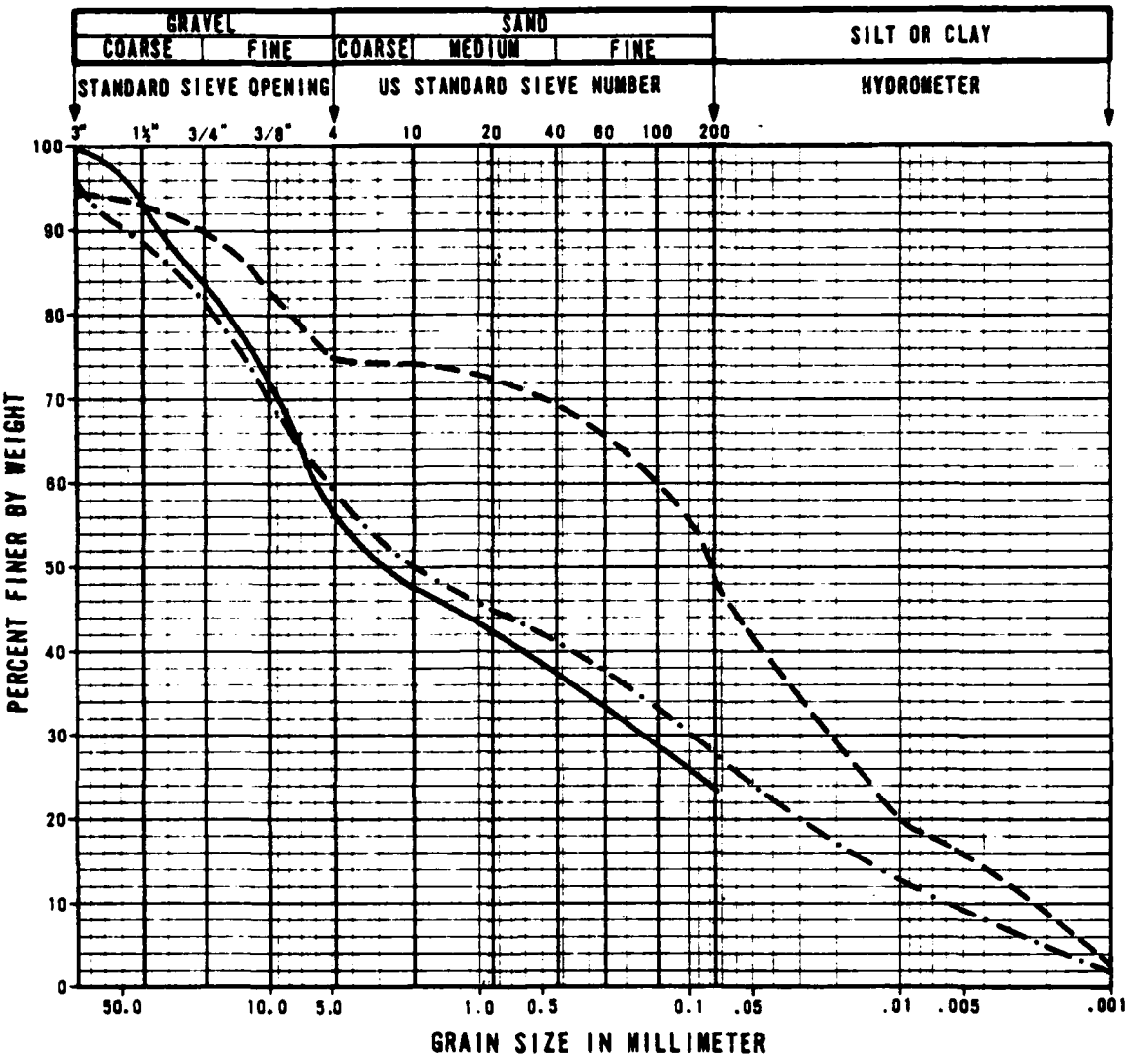
GRAIN SIZE CURVES, CBR TESTS
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 9-1
1 OF 2

CHECKED BY _____ APPROVED BY _____

2 JUL 78



SYMBOL	COMPOSITE SAMPLE NUMBER	ACTIVITY NUMBER	SAMPLE INTERVAL		SOIL TYPE
			FEET	METERS	
———	E'	WW-P-14	0.4-2.0	0.12-0.61	GM-GC
– – –	F	WW-P-4 WW-CS-45	0.4-2.0	0.12-0.61	SM-SC
—·—	G	WW-P-10 WW-CS-58	0.25-1.0	0.08-0.30	GC

GRAIN SIZE CURVES, CRB TESTS
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 9-1 2 OF 2

FUGRO NATIONAL, INC.

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2 JUL 79

AFV-12

CHECKED BY _____ APPROVED BY _____

2 JUL 70

FN-TR-27-11

COMPOSITE SAMPLE NUMBER	SOIL TYPE	PERCENT PASSING #200	ATTERBERG LIMITS		SPECIFIC GRAVITY	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	COMPACTED DRY DENSITY		COMPACTED MOISTURE (%)	PERCENT OF MAXIMUM DRY DENSITY	CBR (%)
			LL	PI		pcf	kg/m³		pcf	kg/m³			
A	SM	28			2.71	132.8	2127	7.8	122.1	1955	7.9	91.9	44
									114.5	1833	7.8	86.2	12
B	SM	40		NP		131.5	2106	9.1	117.9	1889	9.0	89.7	18
									113.2	1813	8.6	86.1	7
C	CL	74	39	15		115.0	1842	16.0	110.2	1766	16.4	95.8	23
									103.1	1651	16.5	89.7	9
									92.5	1481	17.1	80.4	4
D	SM	16				139.7	2238	7.0	129.5	2074	6.9	92.7	78
									123.5	1979	7.1	88.4	24

CALIFORNIA BEARING RATIO (CBR) TEST RESULTS
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE 9-4 1 OF 2

FUGRO NATIONAL, INC.

AFV-13

CHECKED BY _____ / _____ APPROVED BY _____ / _____

2 JUL 79

FM-1R-27-11

COMPOSITE SAMPLE NUMBER	SOIL TYPE	PERCENT PASSING #200	ATTERBERG LIMITS		SPECIFIC GRAVITY	MAXIMUM DRY DENSITY		OPTIMUM MOISTURE (%)	COMPACTED DRY DENSITY		COMPACTED MOISTURE (%)	PERCENT OF MAXIMUM DRY DENSITY	CBR (%)
			LL	PI		pcf	kg/m³		pcf	kg/m³			
E	GM-GC	23	25	4		130.5	2235	6.1	128.9	2065	6.6	92.4	44
									124.5	1994	6.1	89.2	18
F	SM-SC	49	28	6		128.0	2051	9.5	126.7	2030	10.2	99.0	84
									121.9	1953	10.2	95.2	51
									112.4	1801	9.7	87.8	10
G	GC	28	27	8		137.0	2195	7.0	127.7	2046	7.0	93.2	65
									120.5	1930	7.0	88.0	18

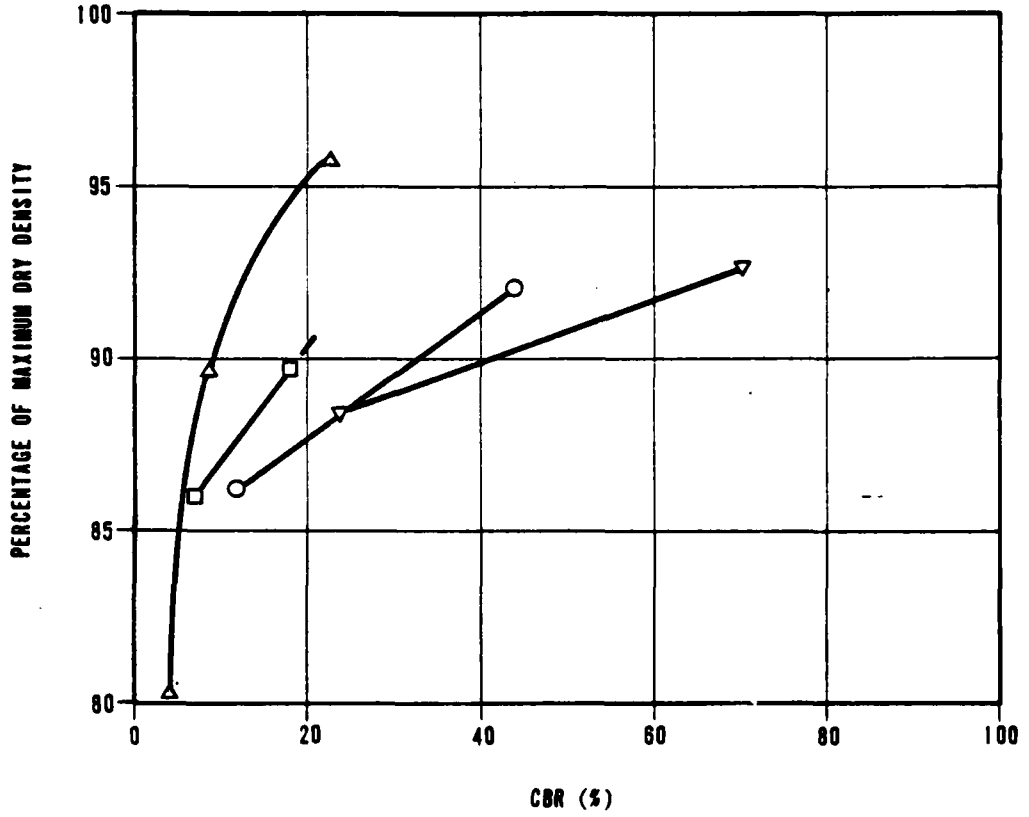
CALIFORNIA BEARING RATIO (CBR) TEST RESULTS
VERIFICATION SITE, WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

TABLE 9-4 2 OF 2

WOODWARD-NATIONAL, INC.

AFV-13



SYMBOL	COMPOSITE SAMPLE NUMBER	SOIL TYPE
○	A	SM
□	B	SM
△	C	CL
▽	D	SM

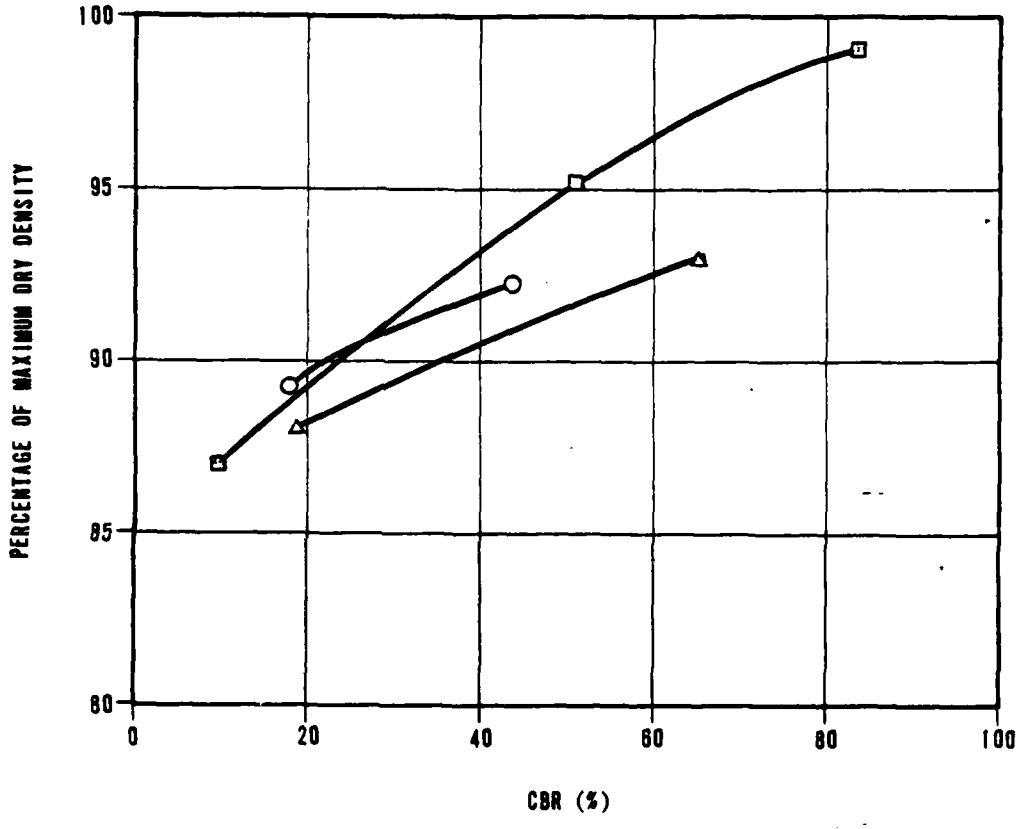
CHECKED BY _____ APPROVED BY _____

CALIFORNIA BEARING RATIO (CBR) CURVES
VERIFICATION SITE, WHIRLWIND COP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 9-2 1 OF 2

FUGRO NATIONAL, INC.



SYMBOL	COMPOSITE SAMPLE NUMBER	SOIL TYPE
○	E	GM-GC
□	F	SM-SC
△	G	GC

CHECKED BY _____ APPROVED BY _____

CALIFORNIA BEARING RATIO (CBR) CURVES
VERIFICATION SITE, WHIRLWIND CDP, UTAH

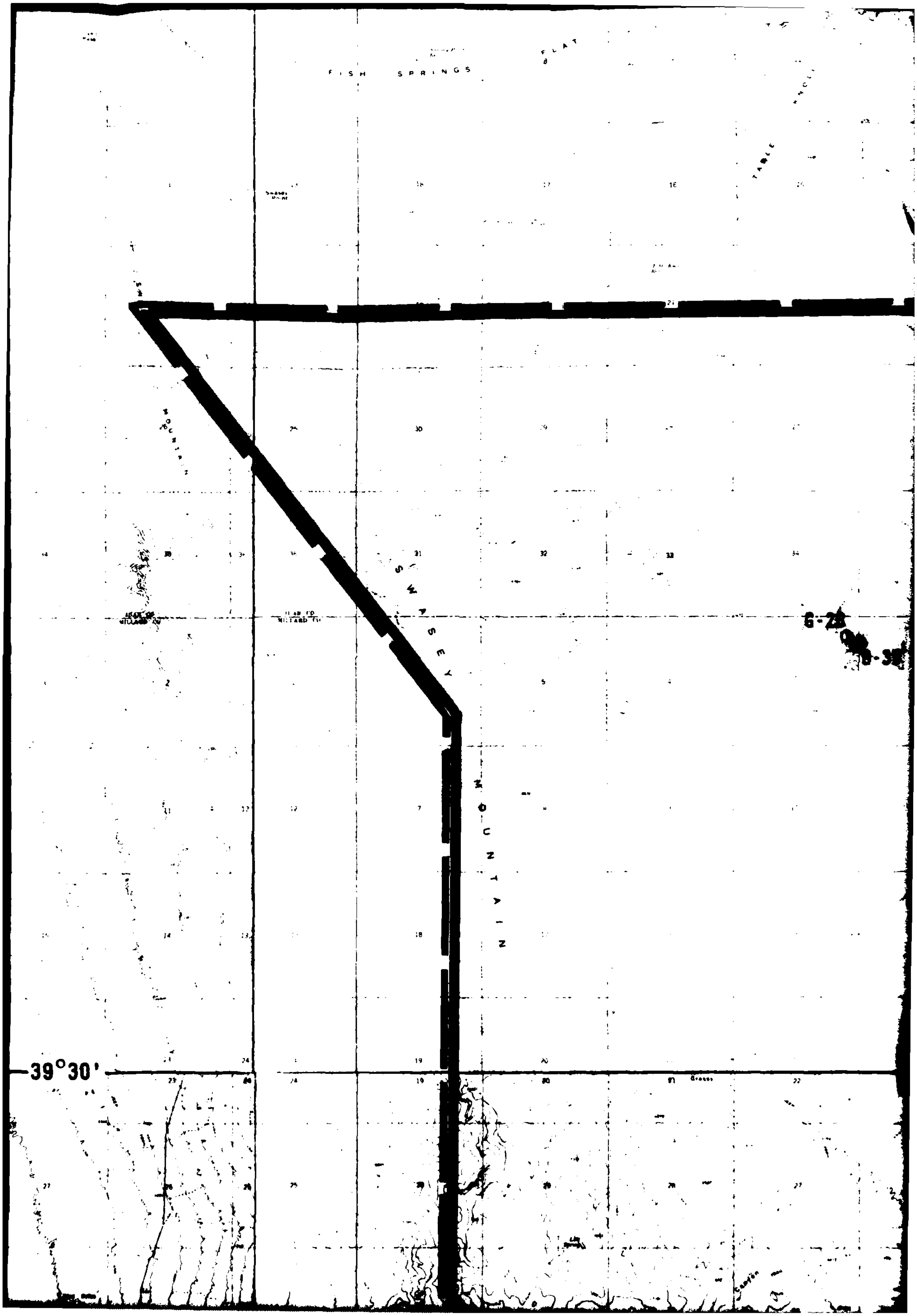
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

FIGURE 9-2 2 OF 2

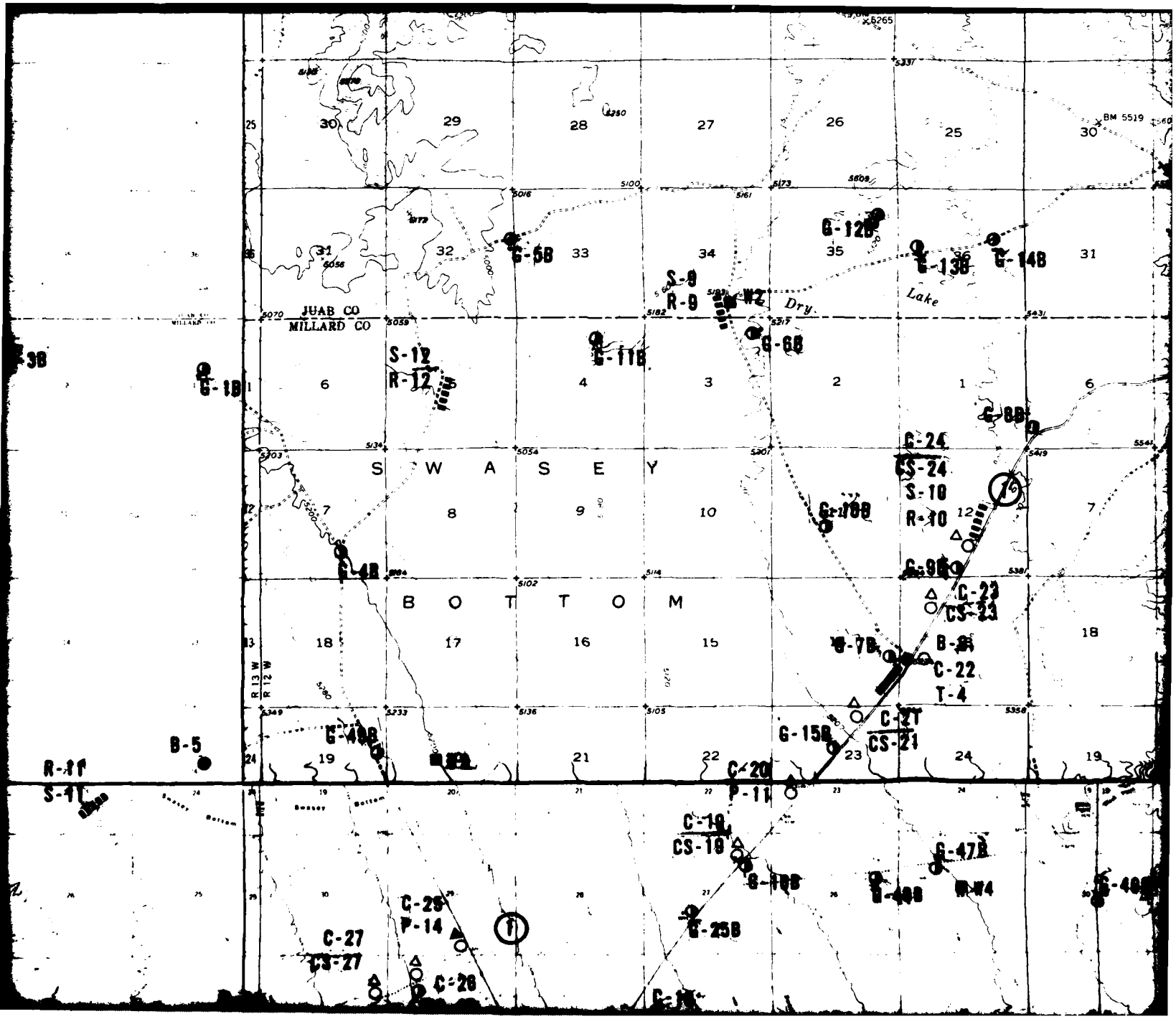
FUGRO NATIONAL, INC.

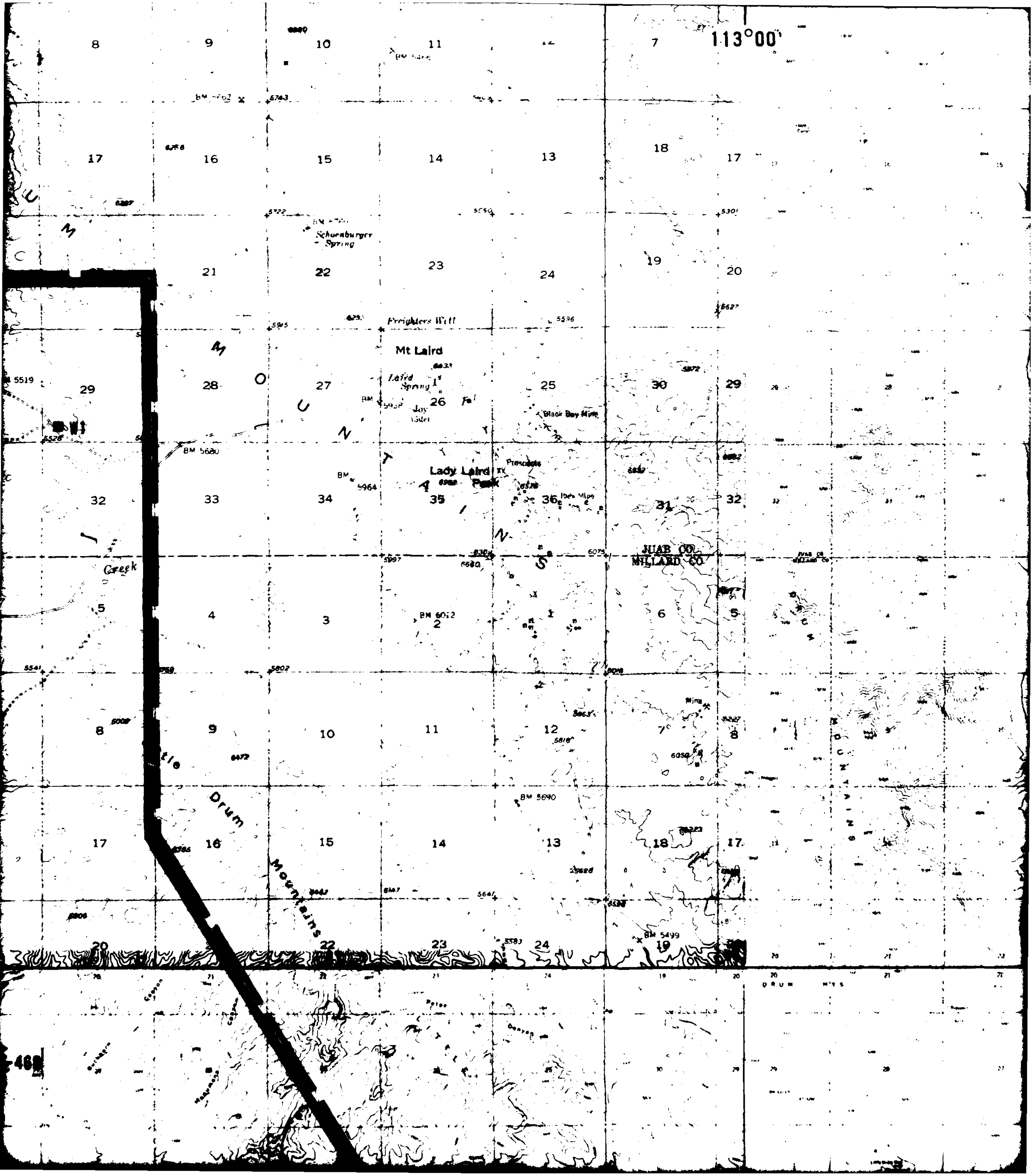
2 JUL 79

AFV-14

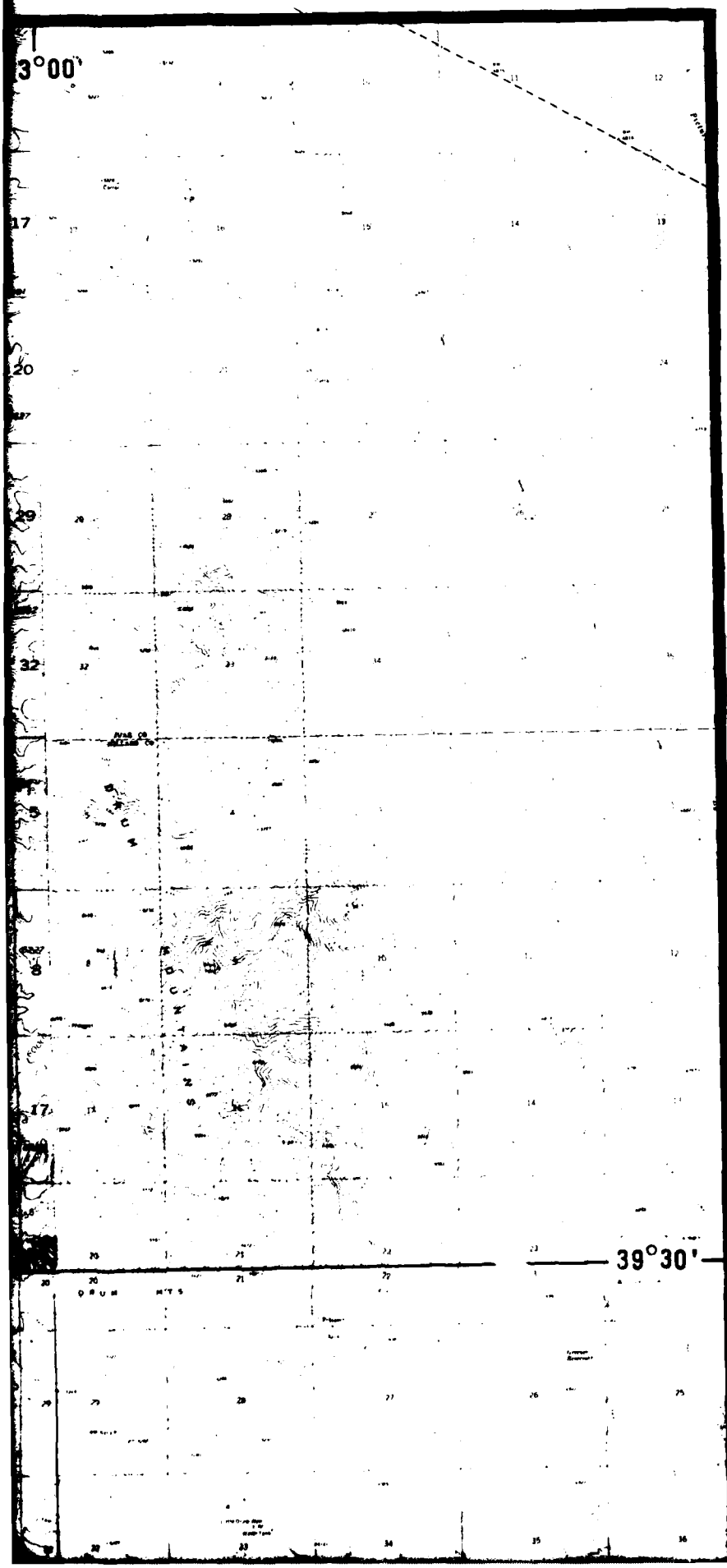


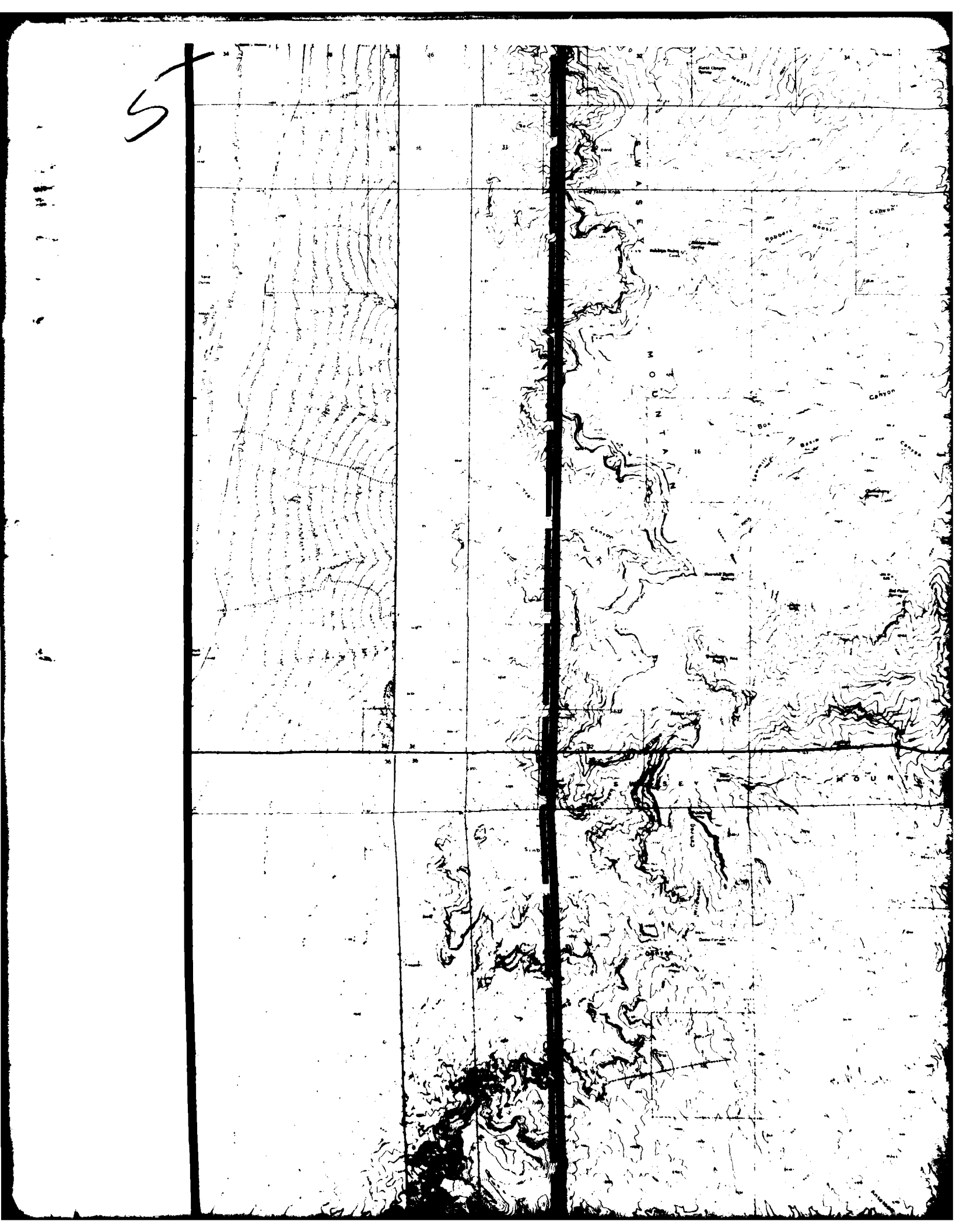
FISH SPRINGS
FLAT
SWASEY
MOUNTAIN
G-28
39°30'

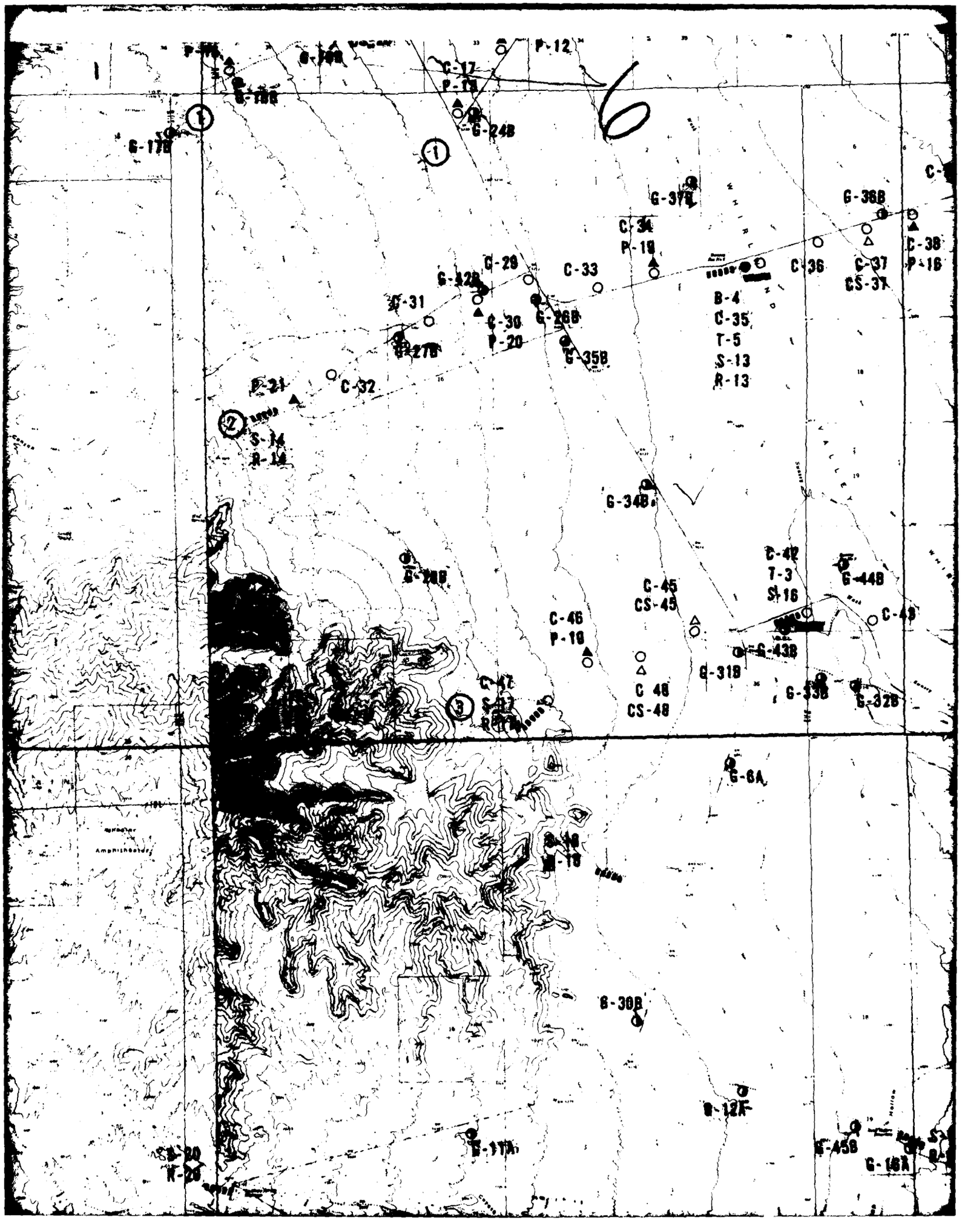

JUAB CO
MILLARD CO
S W A S E Y
B O T T O M
Dry
Lake
G-12B
G-13B
G-14B
G-5B
G-11B
G-6B
G-8B
G-10B
G-9B
G-7B
G-15B
G-4B
G-49B
G-47B
G-48B
G-25B
S-9
R-9
S-12
R-12
C-24
CS-24
S-10
R-10
C-23
CS-23
C-22
T-4
C-21
CS-21
C-20
P-11
C-19
CS-19
C-25
P-14
C-27
CS-27
C-26
B-5
R-11
S-11
R 13 W
R 12 W
BM 5519



113°00'
Schoenburger Spring
Freighters Well
Mt Laird
Laird Spring
Joy (Site)
Black Boy Mine
Lady Laird Peak
Prospects
JUAB CO.
MILLARD CO.
Creek
BM 5680
BM 5964
BM 6012
BM 5690
BM 5499
Mine
Drum
Mountains


3°00'
39°30'




6
P-12
C-17
P-18
G-24B
G-17B
G-37B
G-36B
C-34
P-19
C-38
P-16
C-29
C-33
C-36
C-37
CS-37
G-32B
C-31
B-4
C-35
T-5
S-13
R-13
C-30
G-26B
P-20
G-27B
G-35B
P-21
C-32
S-14
R-14
G-34B
G-28B
C-42
T-3
S-16
G-44B
C-45
CS-45
C-46
P-19
C-49
G-43B
G-31B
C-47
S-17
R-17
C-48
CS-48
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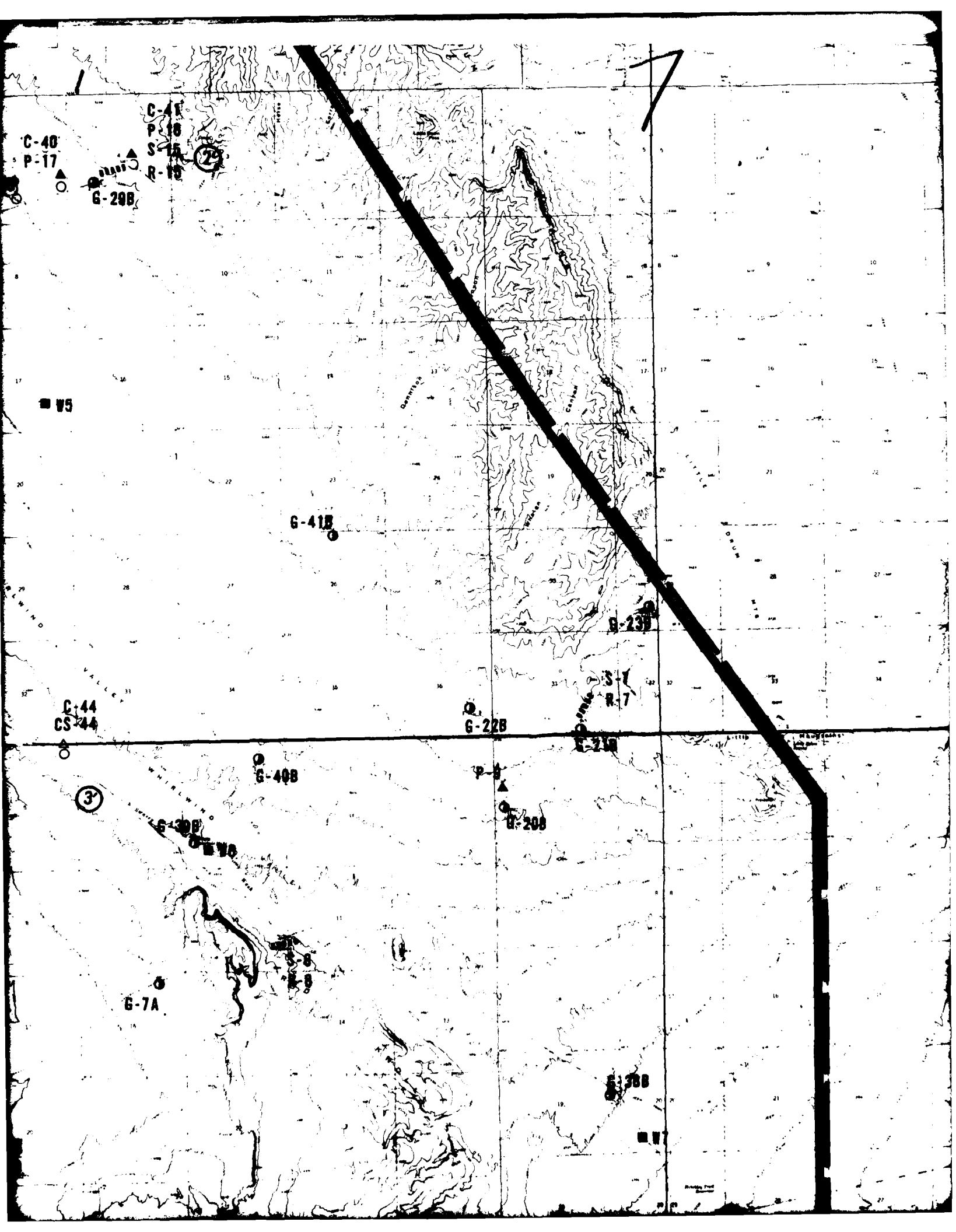
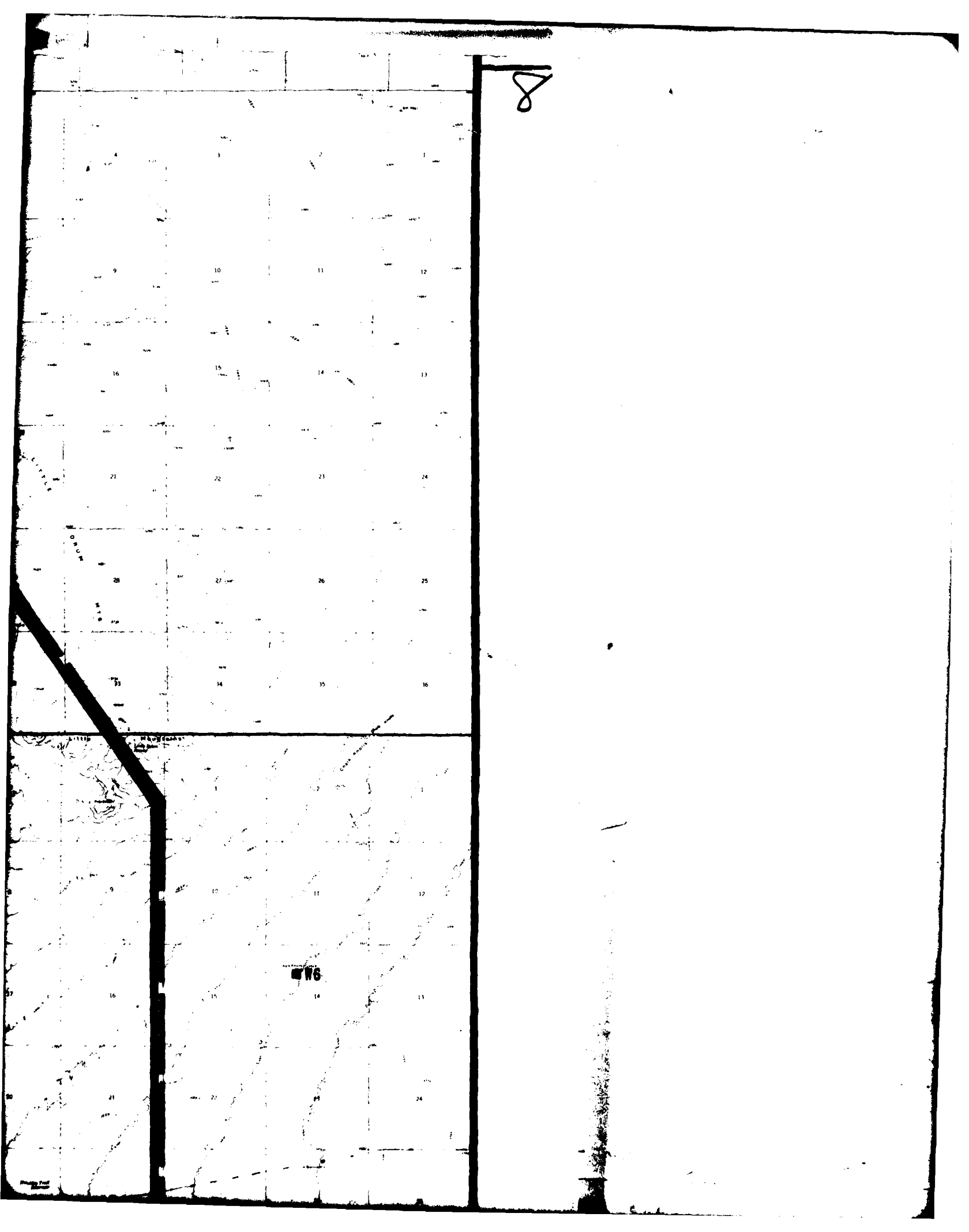
G-6A
G-30B
G-12A
G-45B
G-16A
S-20
R-20


C-41
P-16
S-15
R-15
C-40
P-17
G-29B
V5
G-41B
G-23B
S-1
R-7
C-44
CS-44
G-22B
C-21B
G-40B
P-8
G-20B
G-39B
V6
S-8
S-9
G-7A
G-38B
V7



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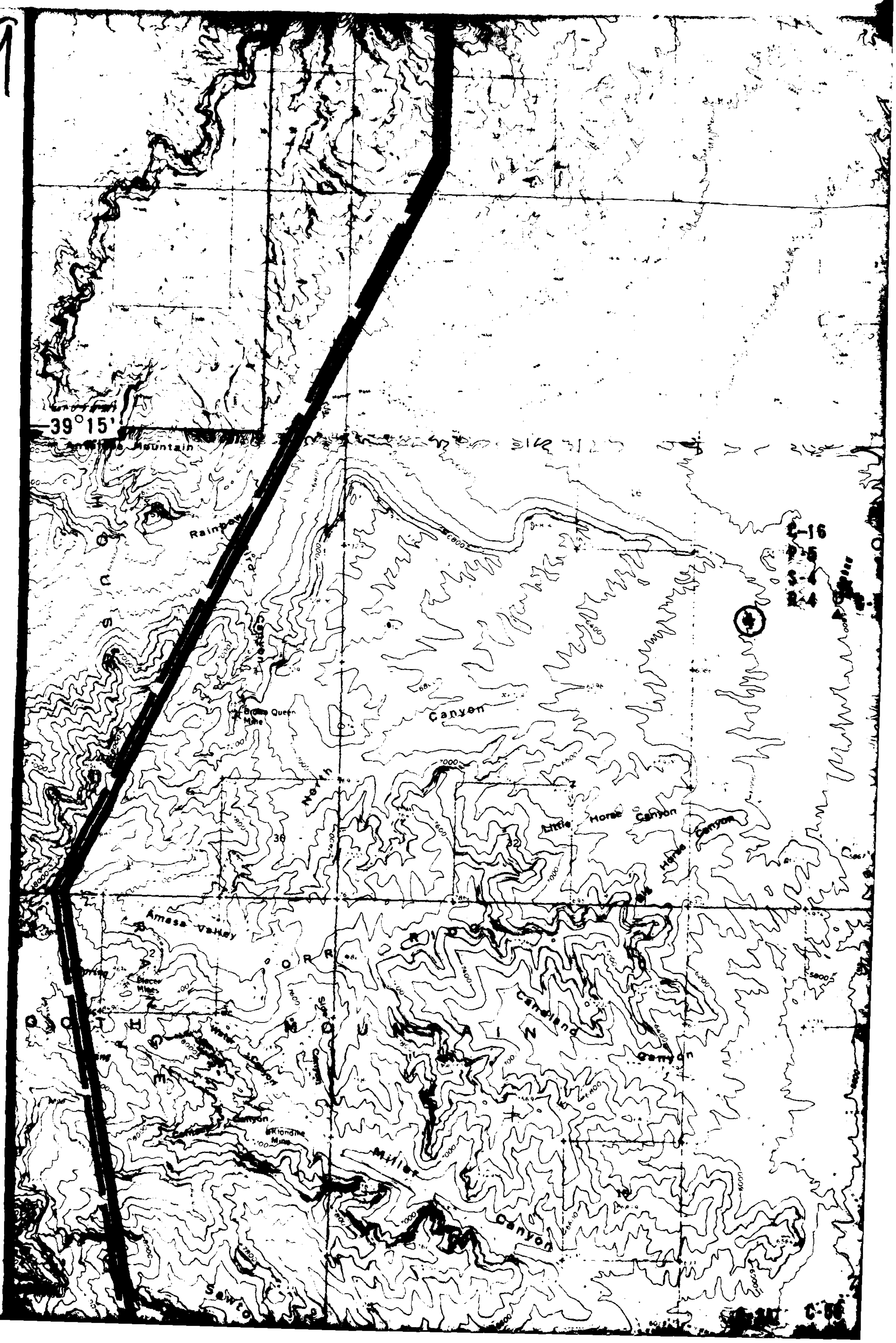
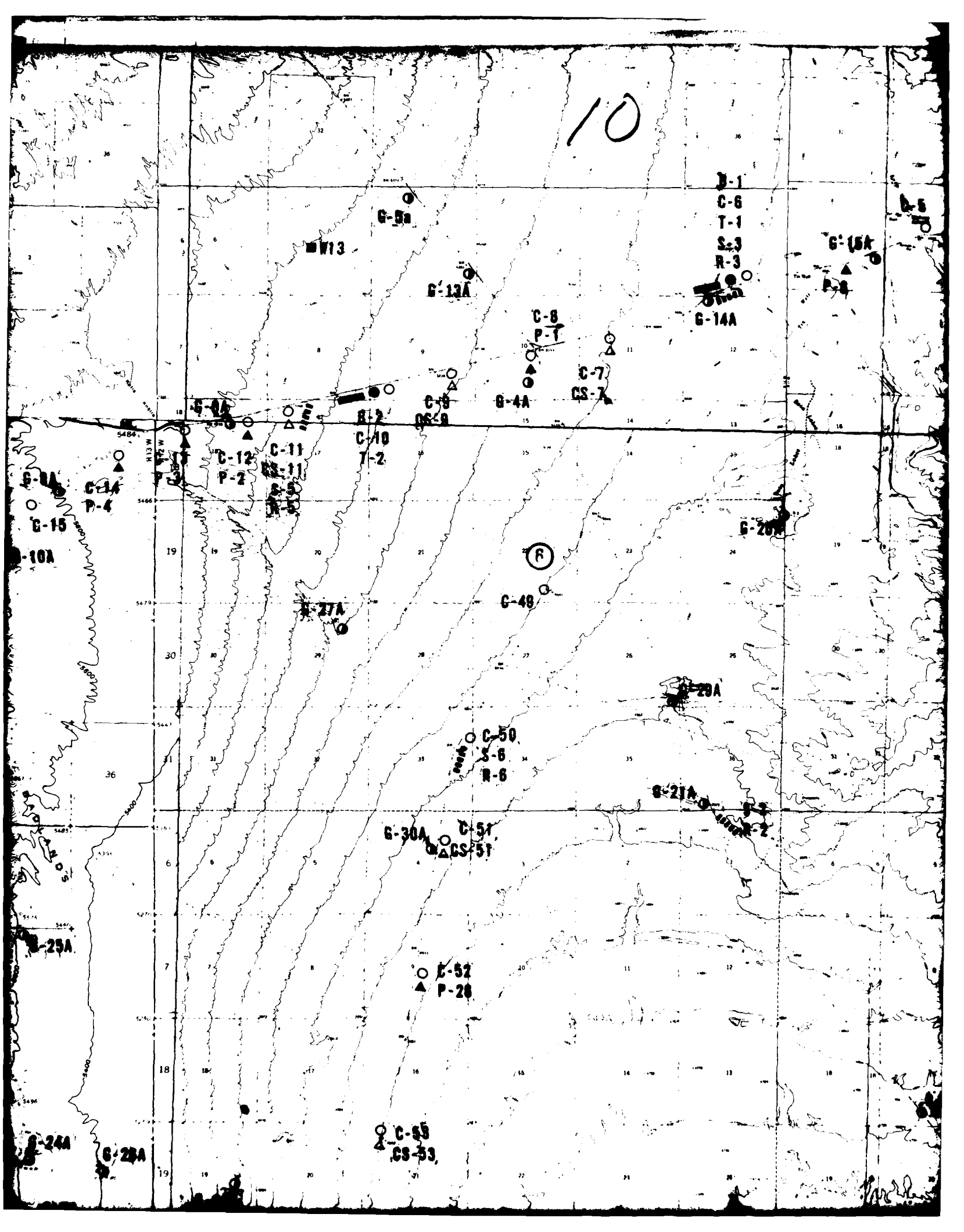


39°15'
Canyon
North
Little Horse Canyon
Horse Canyon
Amasa Valley
Candland
Canyon
Miller
Canyon
C-16


10
G-9a
W13
G-13A
D-1
C-6
T-1
S-3
R-3
G-15A
P-8
G-14A
C-8
P-1
C-7
CS-7
G-4A
G-9A
C-9
R-2
CS-9
C-10
T-2
C-12
P-2
C-11
CS-11
S-5
R-5
P-3
G-8A
C-14
P-4
G-15
G-10A
G-20A
F
G-27A
G-49
G-29A
C-50
S-6
R-6
G-21A
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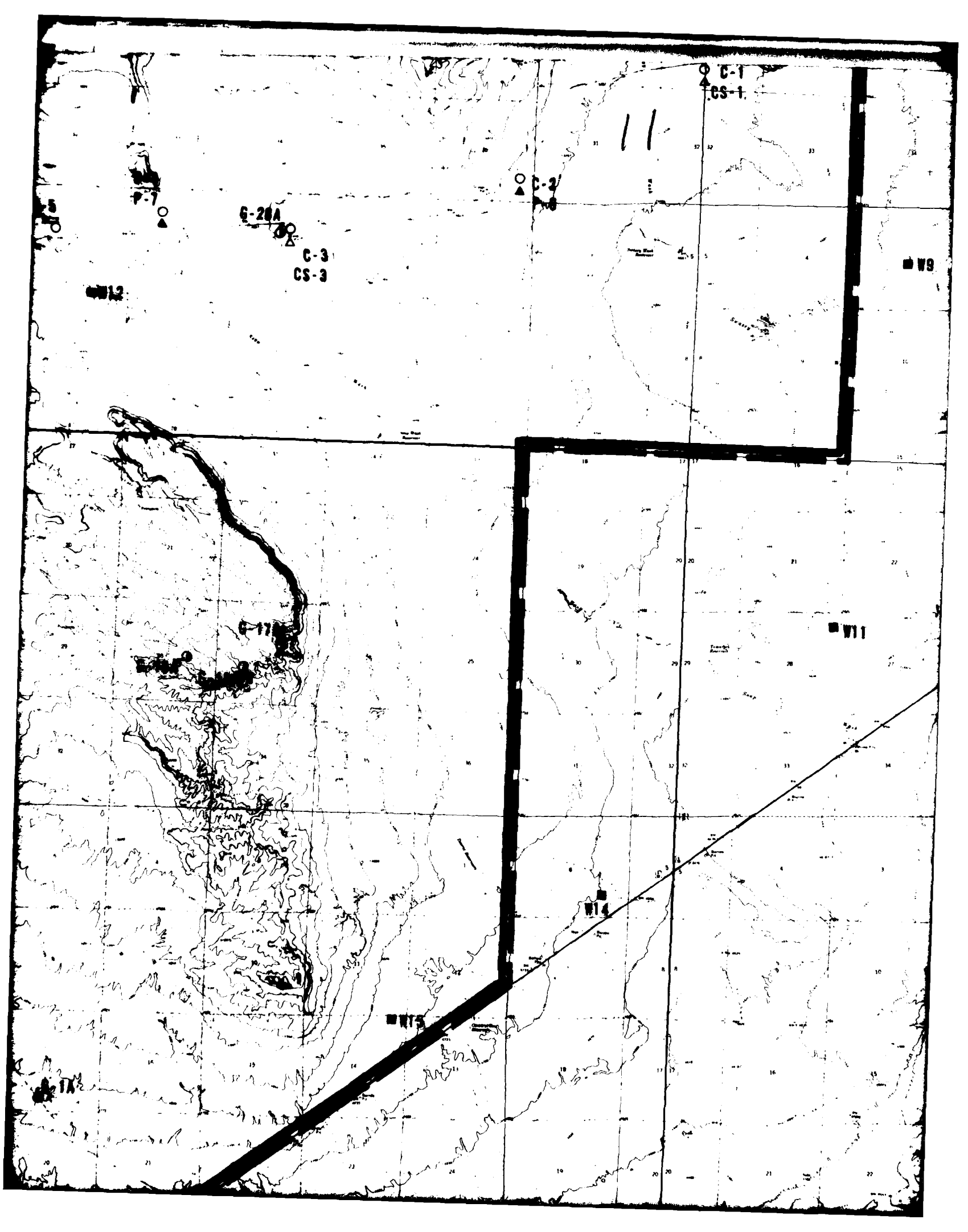
C-51
CS-51
G-25A
C-52
P-28
C-55
CS-55
G-24A
G-28A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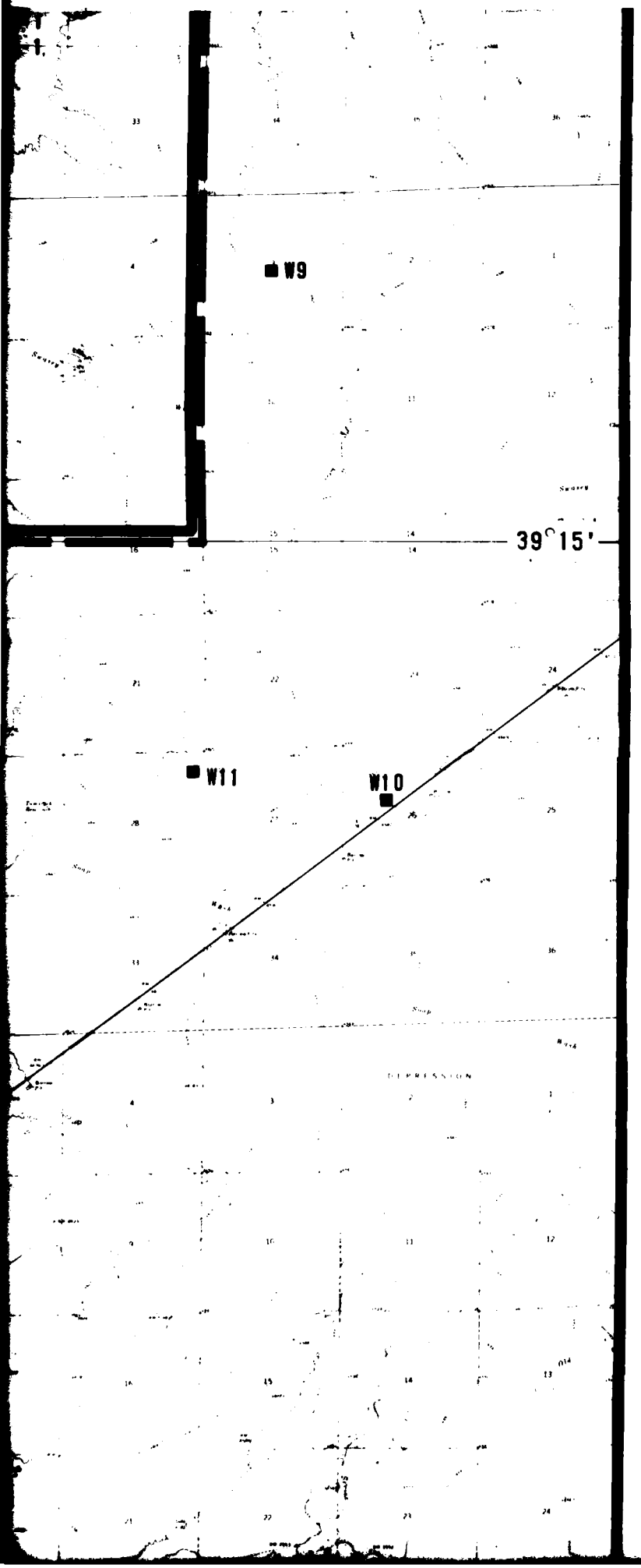
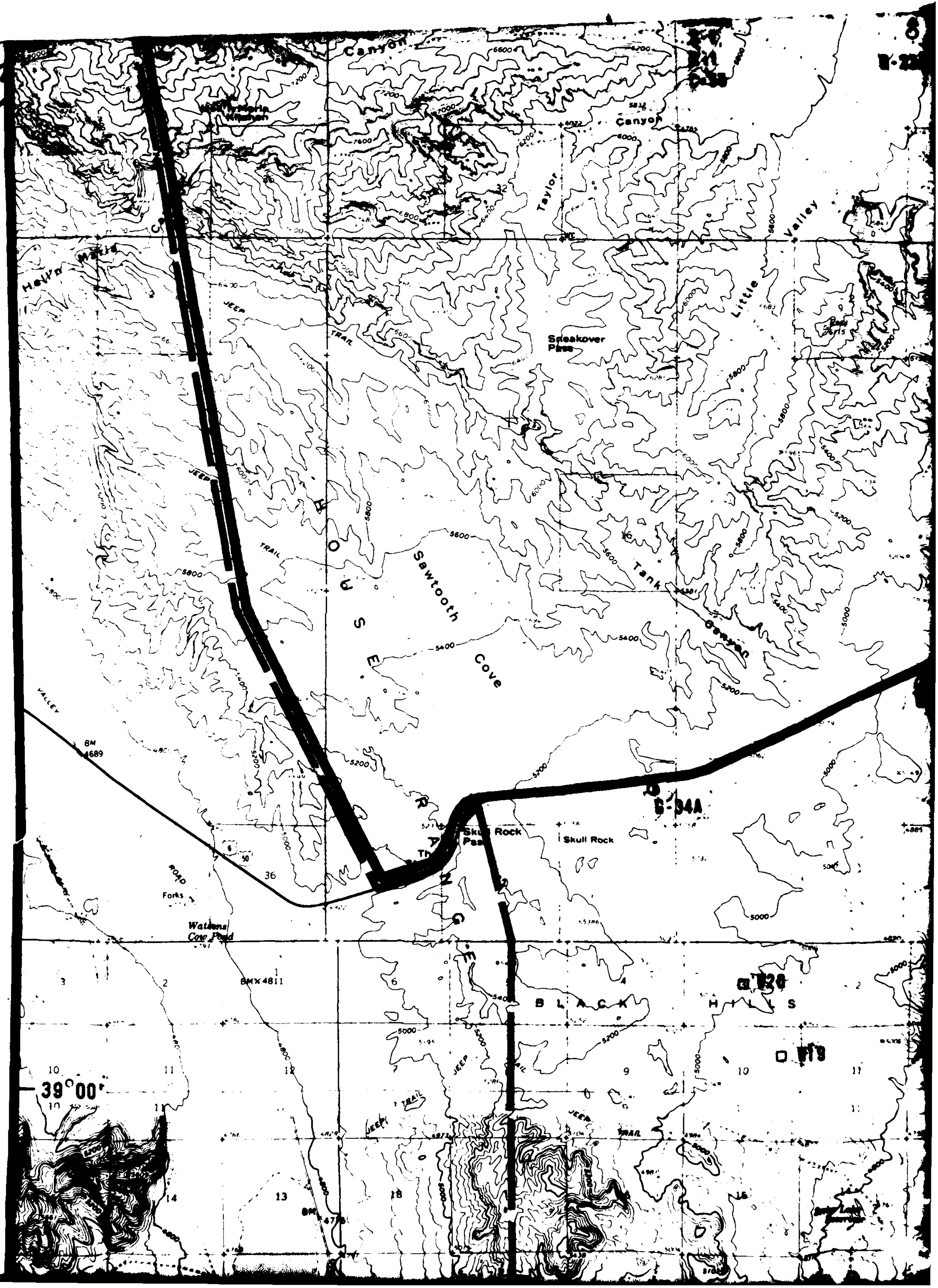
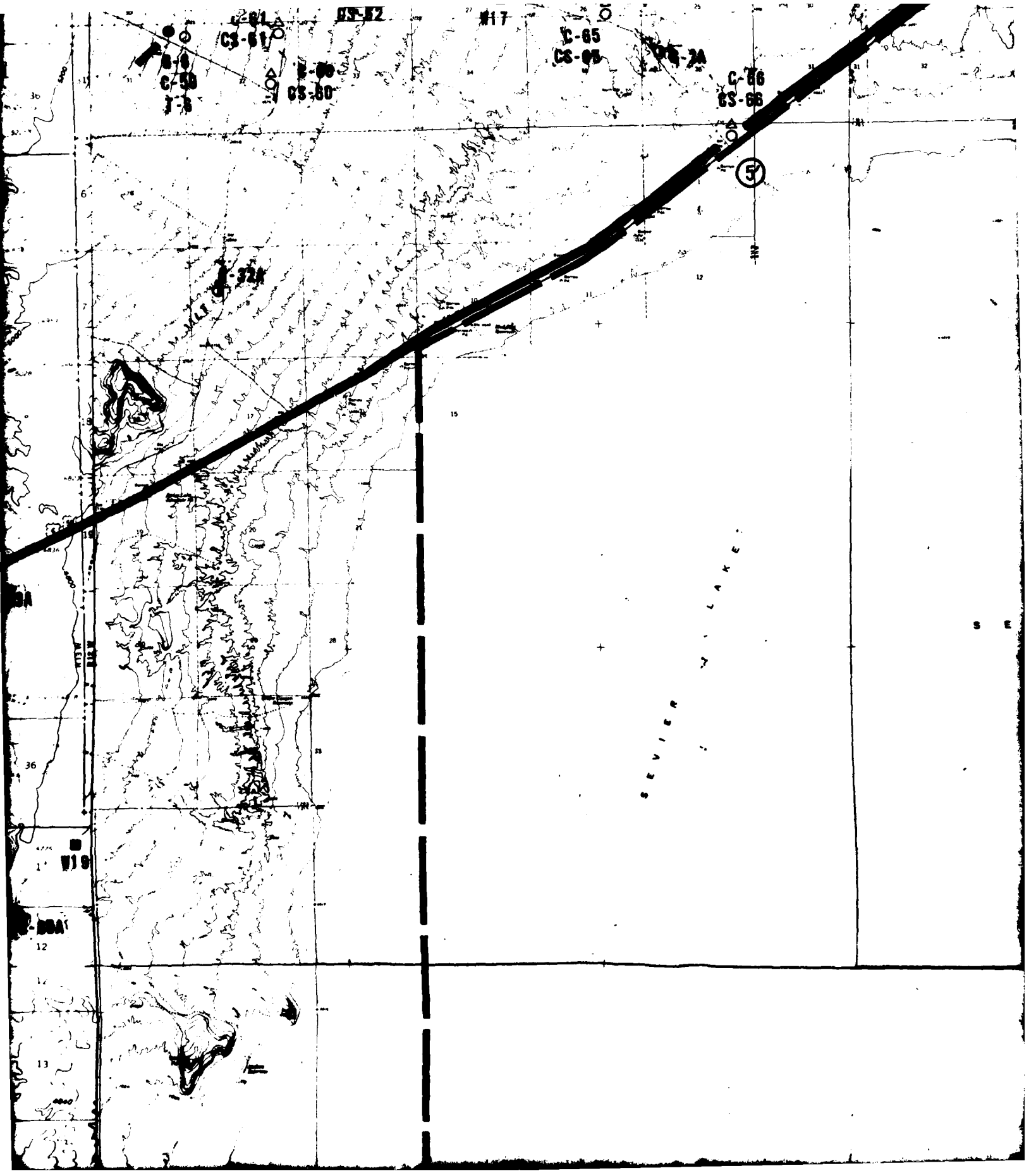
CS-1
C-2
C-2A
C-3
CS-3
W9
W12
W11
W14
W15
1A

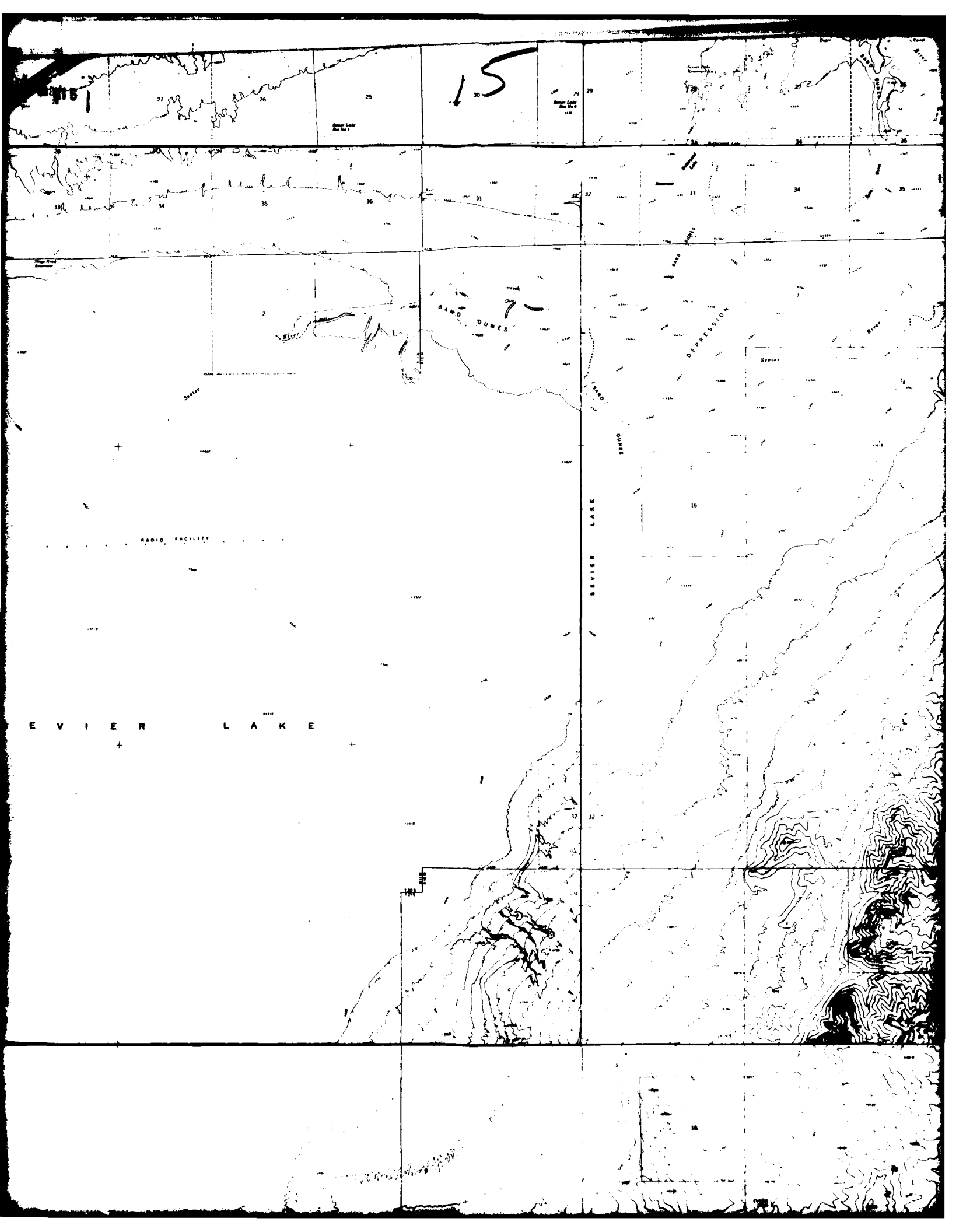


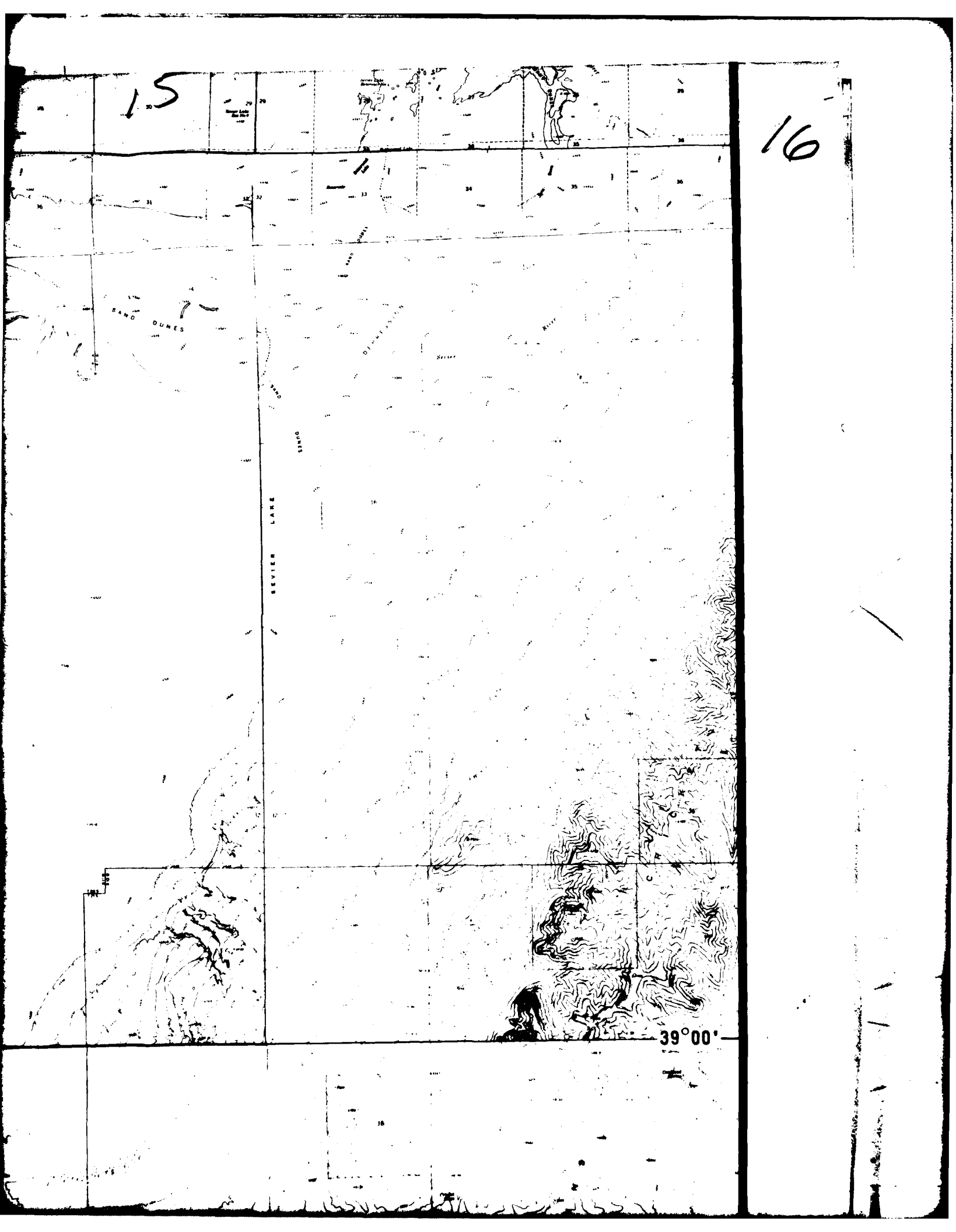
12

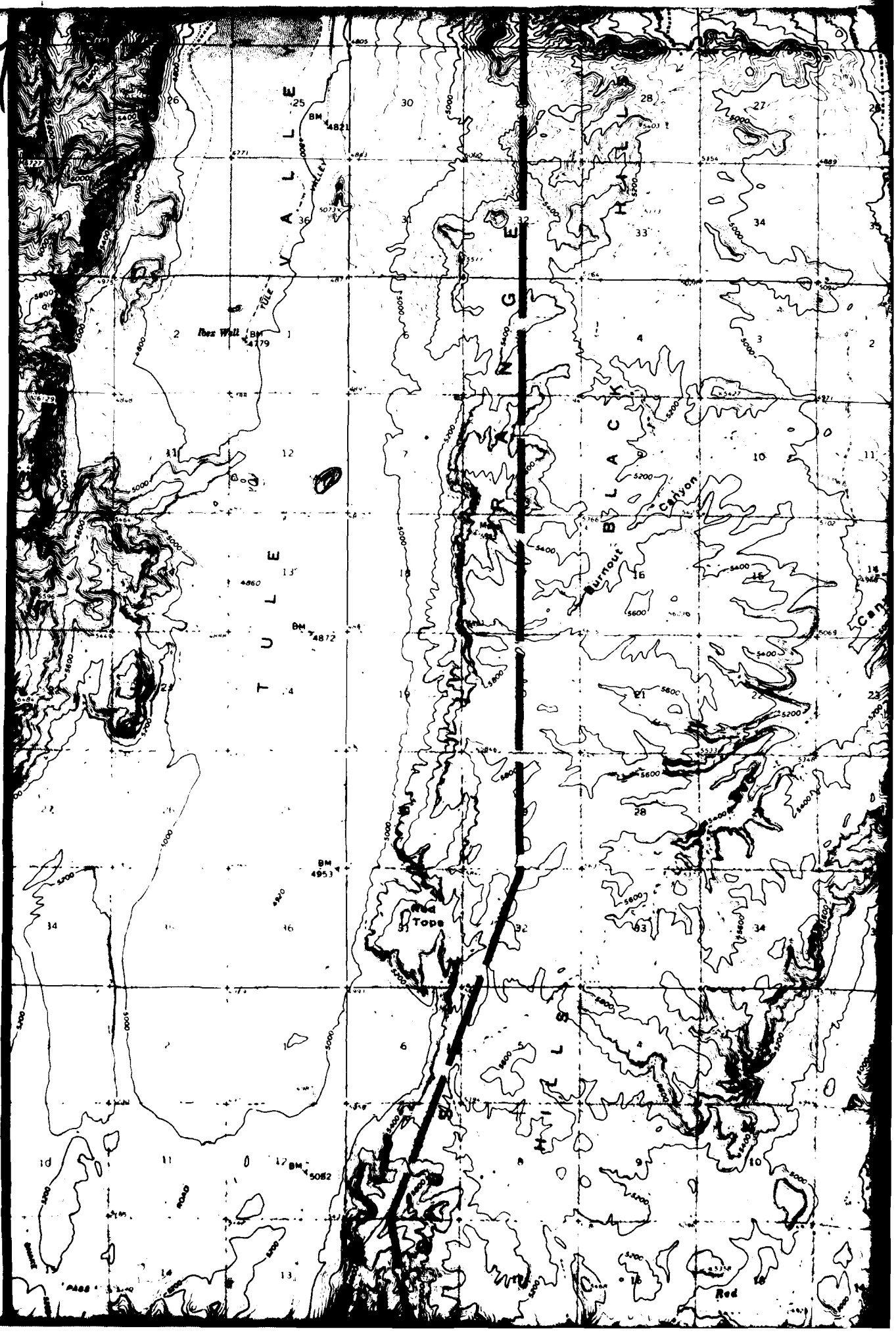
13

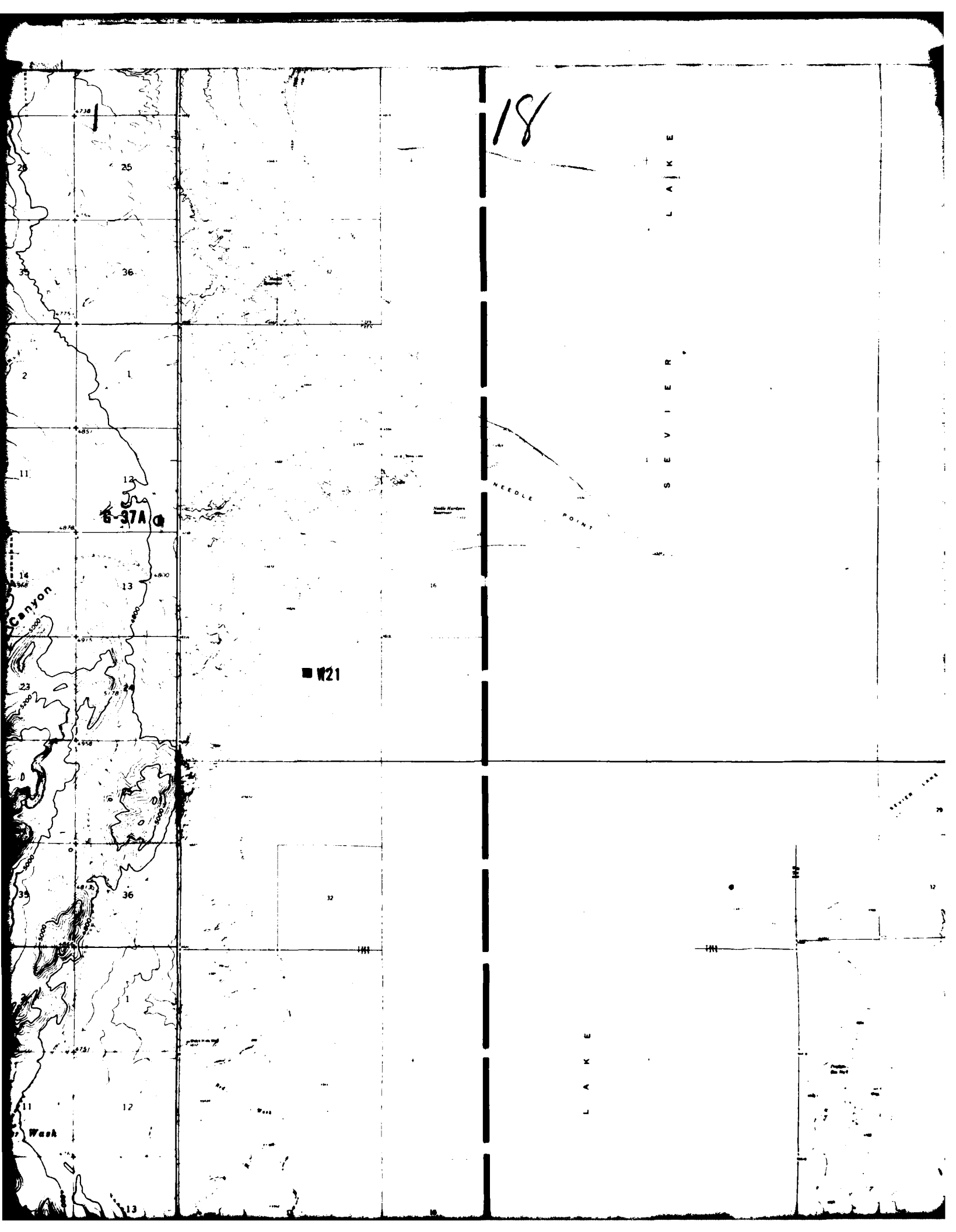

Canyon
Canyon
Taylor
Little Valley
Speakover Pass
JEEP TRAIL
HOUSE RANGE
Sawtooth Cove
Tank Canyon
VALLEY
ROAD
Forks
Watsons Cow Pond
Skull Rock Pass
Skull Rock
G-34A
BLACK HILLS
39°00'

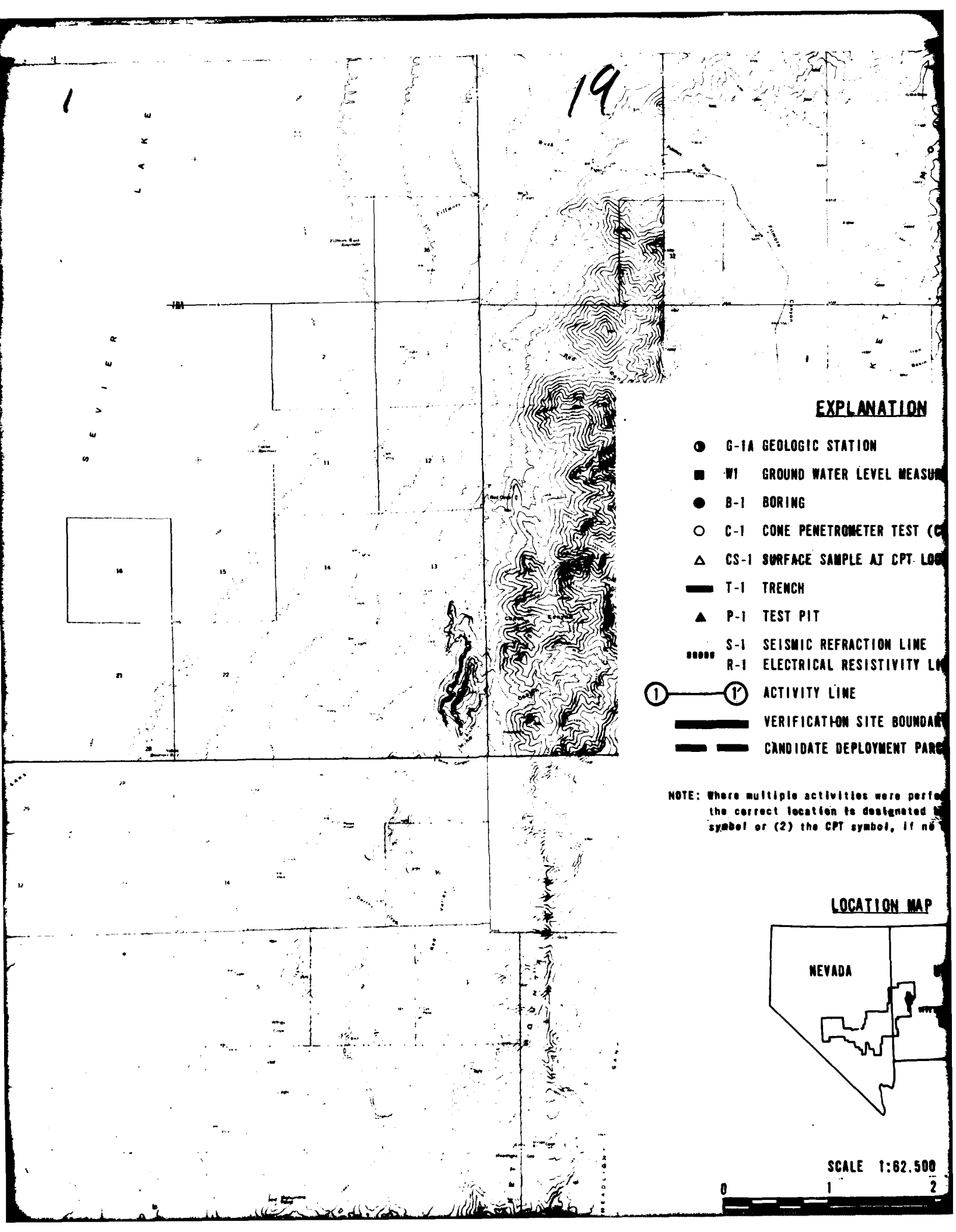

C-65
C-66
CS-66
5
SEVIER LAKE


15
SAND DUNES
DEPRESSION
SEVIER LAKE
RADIO FACILITY
E V I E R L A K E

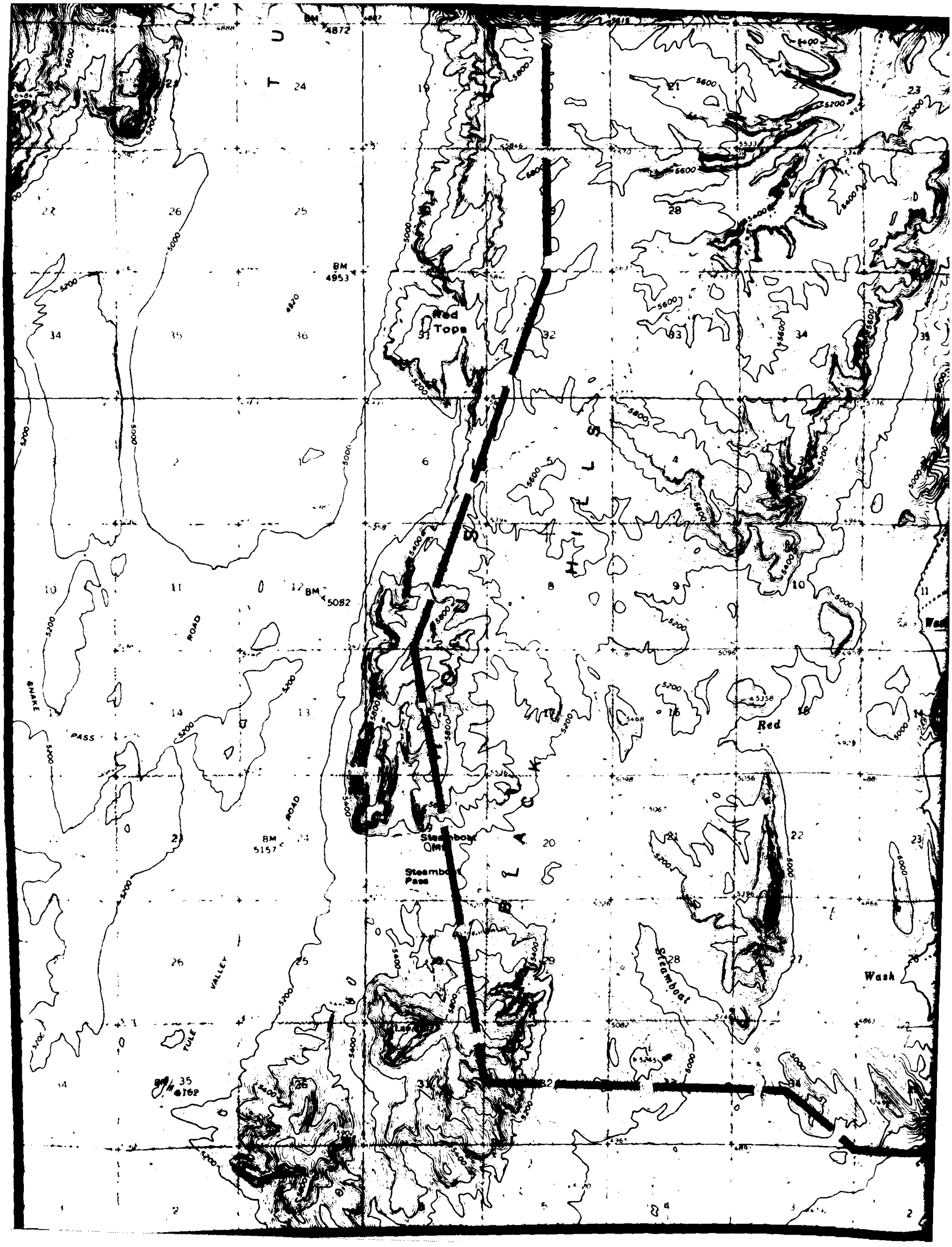

15
16
SAND DUNES
SEVIER LAKE
39°00'


TULE VALLEY
BLACK RIDGE
Rex Well
Burnout Canyon
Red Tops
BM 4821
BM 4872
BM 4953
BM 5082
BM 4779

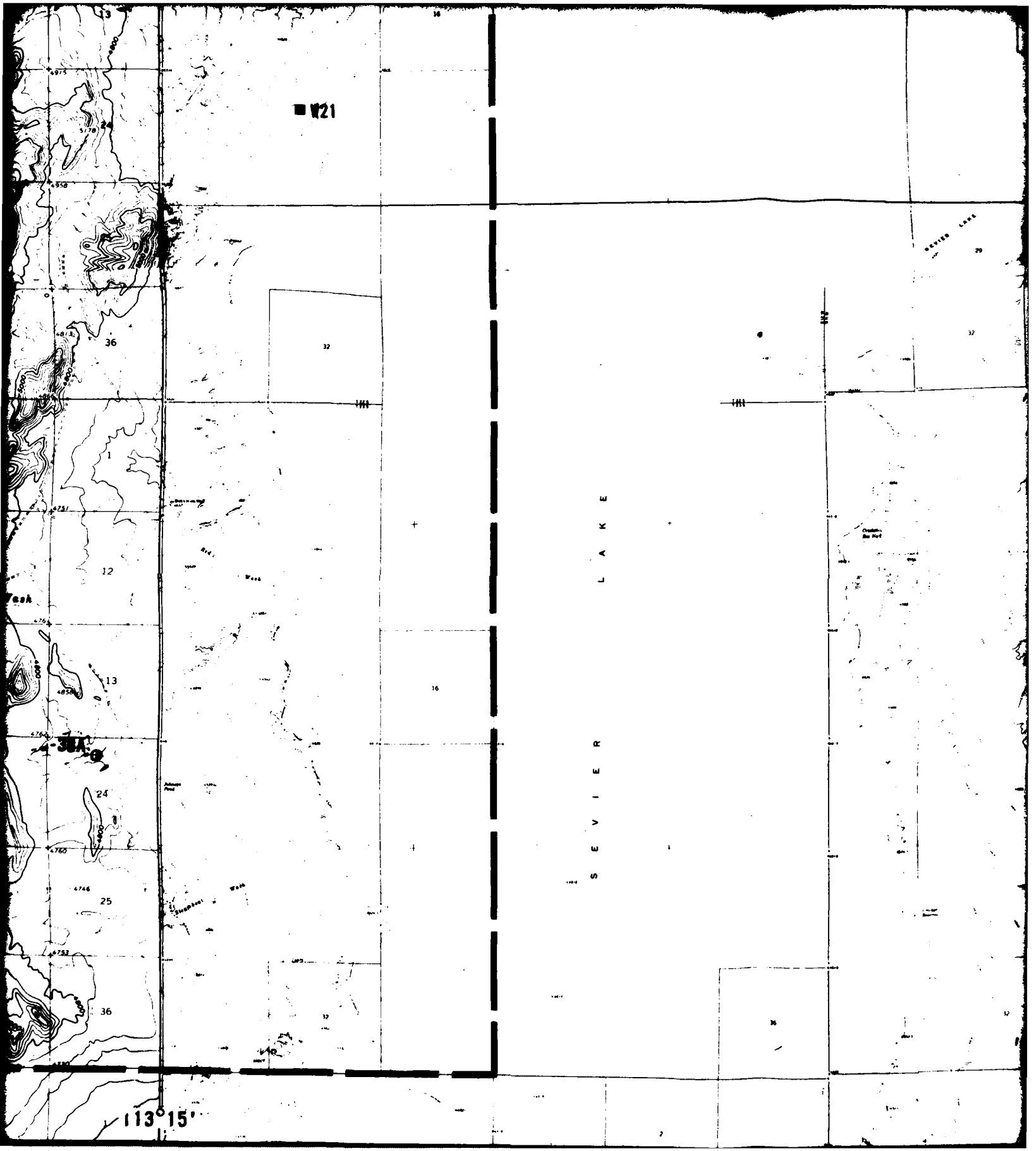

18
SEVIER LAKE
NEEDLE POINT
6-37A
W21
Canyon
Wash
LAKE

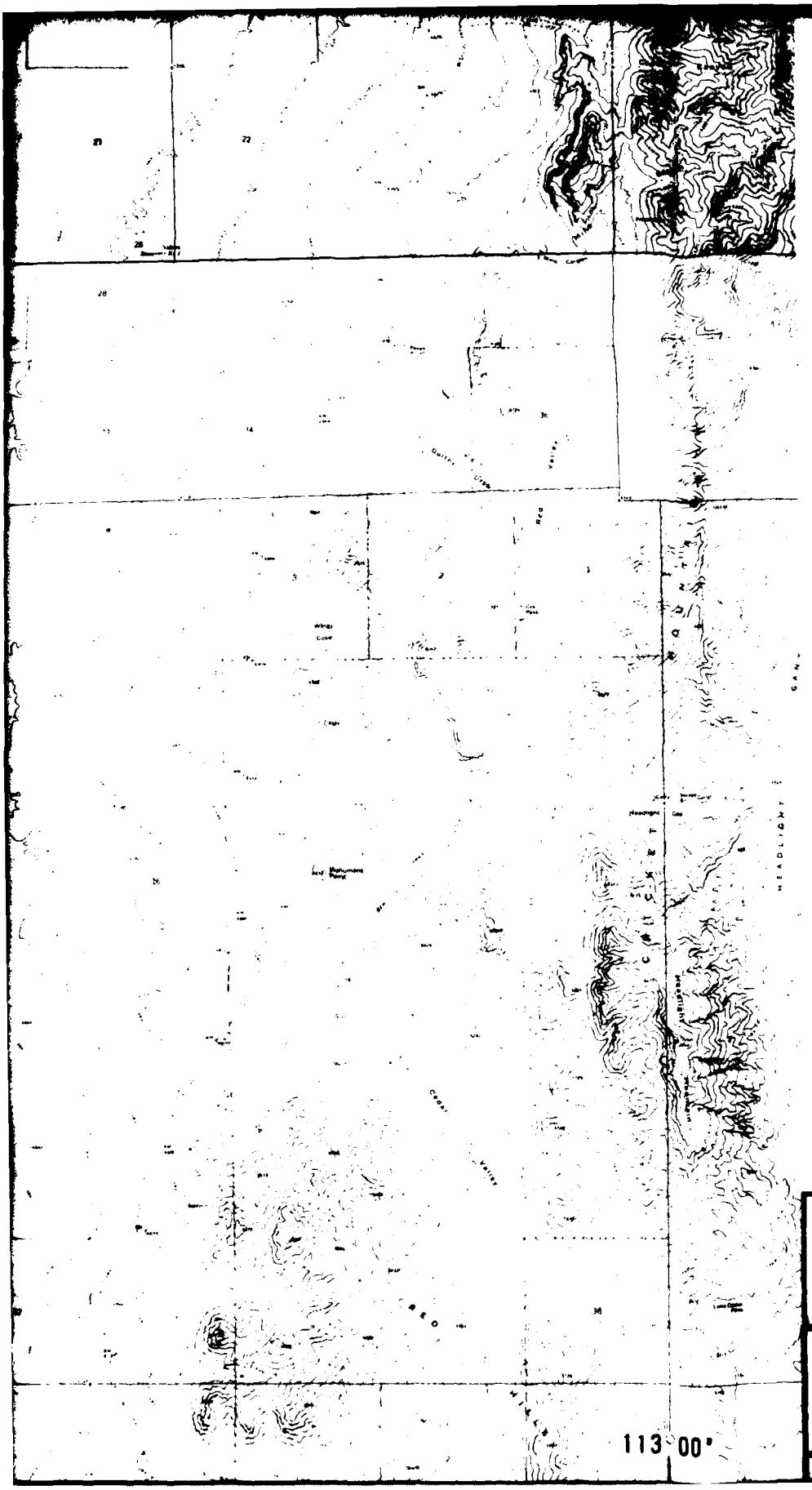

1
19
SEVIER LAKE
EXPLANATION
G-1A GEOLOGIC STATION
W1 GROUND WATER LEVEL MEASU
B-1 BORING
C-1 CONE PENETROMETER TEST (C
CS-1 SURFACE SAMPLE AT CPT LO
T-1 TRENCH
P-1 TEST PIT
S-1 SEISMIC REFRACTION LINE
R-1 ELECTRICAL RESISTIVITY L
1 1' ACTIVITY LINE
VERIFICATION SITE BOUNDA
CANDIDATE DEPLOYMENT PAR
NOTE: Where multiple activities were perfo
the correct location is designated
symbol or (2) the CPT symbol, if n
LOCATION MAP
NEVADA
SCALE 1:62,500
0
1
2

20



BM
4872
BM
4953
Red
Tops
BM
5082
SNAKE
PASS
ROAD
Steamboat
Pass
BM
5157
VALLEY
TULE
Red
Steamboat
Wash


SEVIER LAKE
113°15'



T-1 TRENCH

P-1 TEST PIT

S-1 SEISMIC REFRACTION LINE

R-1 ELECTRICAL RESISTIVITY LINE

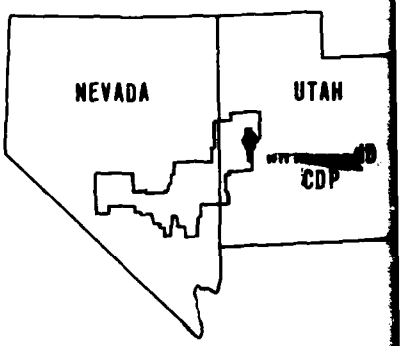
1 — 1' ACTIVITY LINE

VERIFICATION SITE BOUNDARY

CANDIDATE DEPLOYMENT PARCEL (

NOTE: Where multiple activities were performed [illegible] the object to [illegible] symbol or (2) the CPT symbol, if no boring

LOCATION MAP



SCALE 1:62,500

0 1 2

STATUTE MILES

0 1 2

NAUTICAL MILES

0 5,000 10,00

FEET

0 1 2 3

KILOMETERS

ACTIVITY LOCATION MAP
WHIRLWIND CDP, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMS

FUGRO NATIONA

PIT

IC REFRACTION LINE

RICAL RESISTIVITY LINE

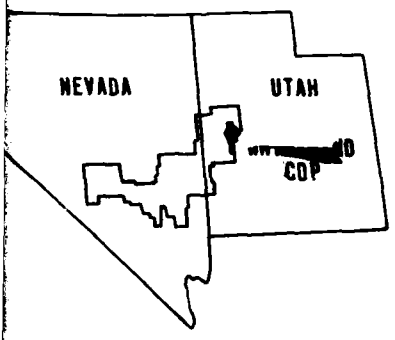
ITY LINE

ICATION SITE BOUNDARY

DATE DEPLOYMENT PARCEL (CDP) BOUNDARY

activities were performed at the same location.
tion is designated by either (T) the boring
the CPT symbol, if no boring was drilled.

LOCATION MAP



SCALE 1:62,500

1 2 3

STATUTE MILES

1 2 3

NAUTICAL MILES

0 5,000 10,000

FEET

0 1 2 3

KILOMETERS

ACTIVITY LOCATION MAP
WHIRLWIND CDP, UTAH

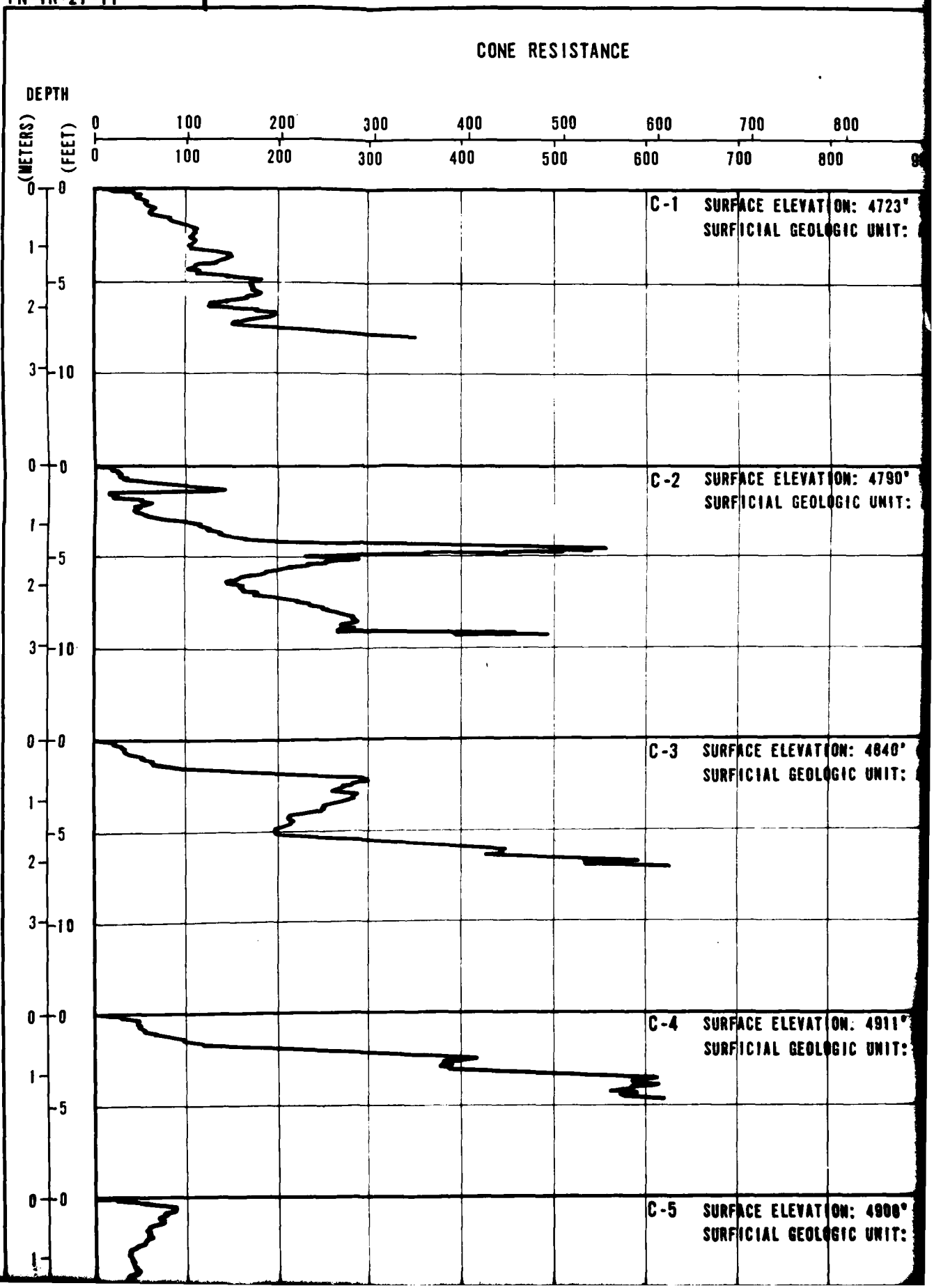
ING INVESTIGATION
F THE AIR FORCE - SAMSO

DRAWING
1

NATIONAL, INC.

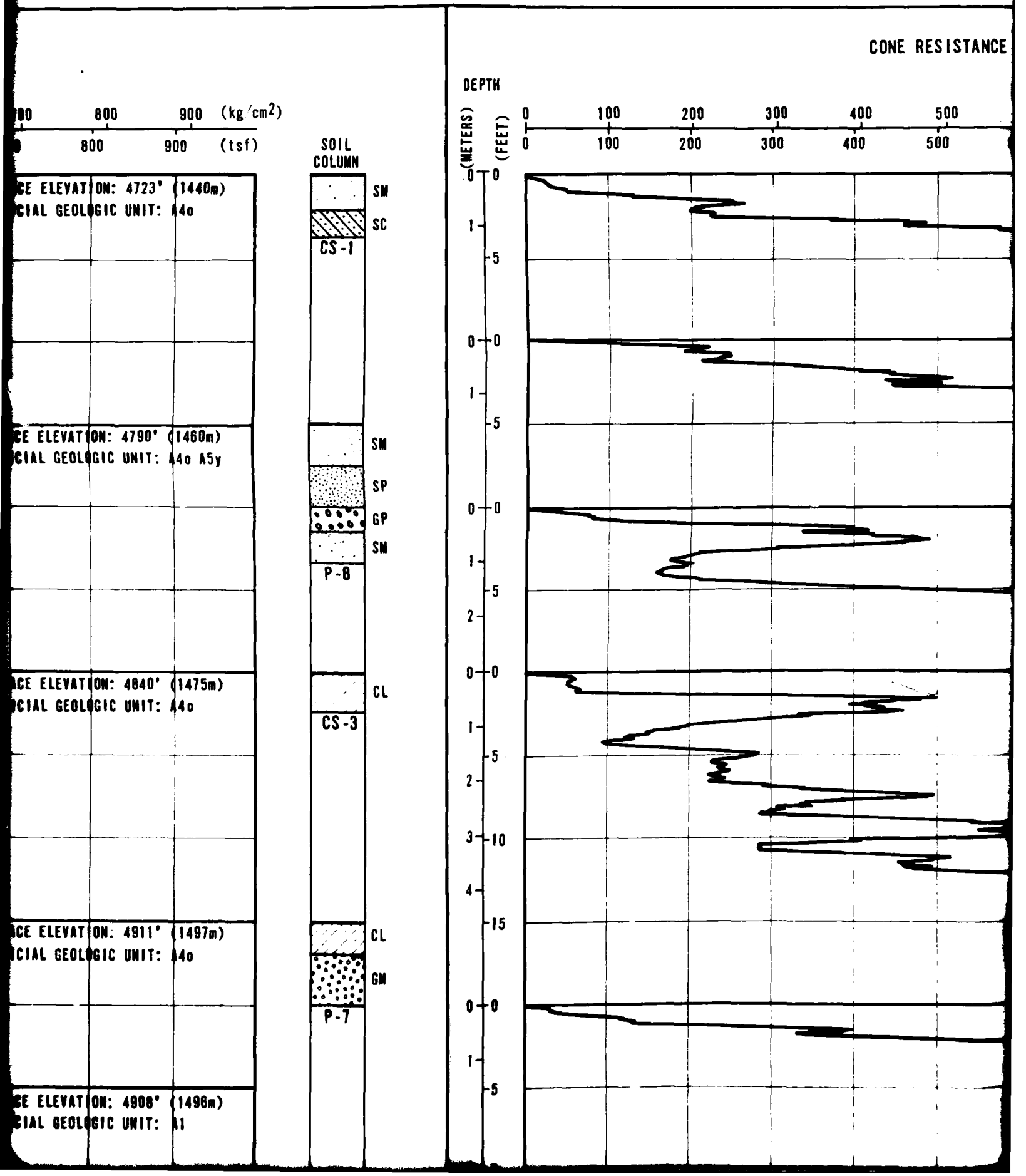
24

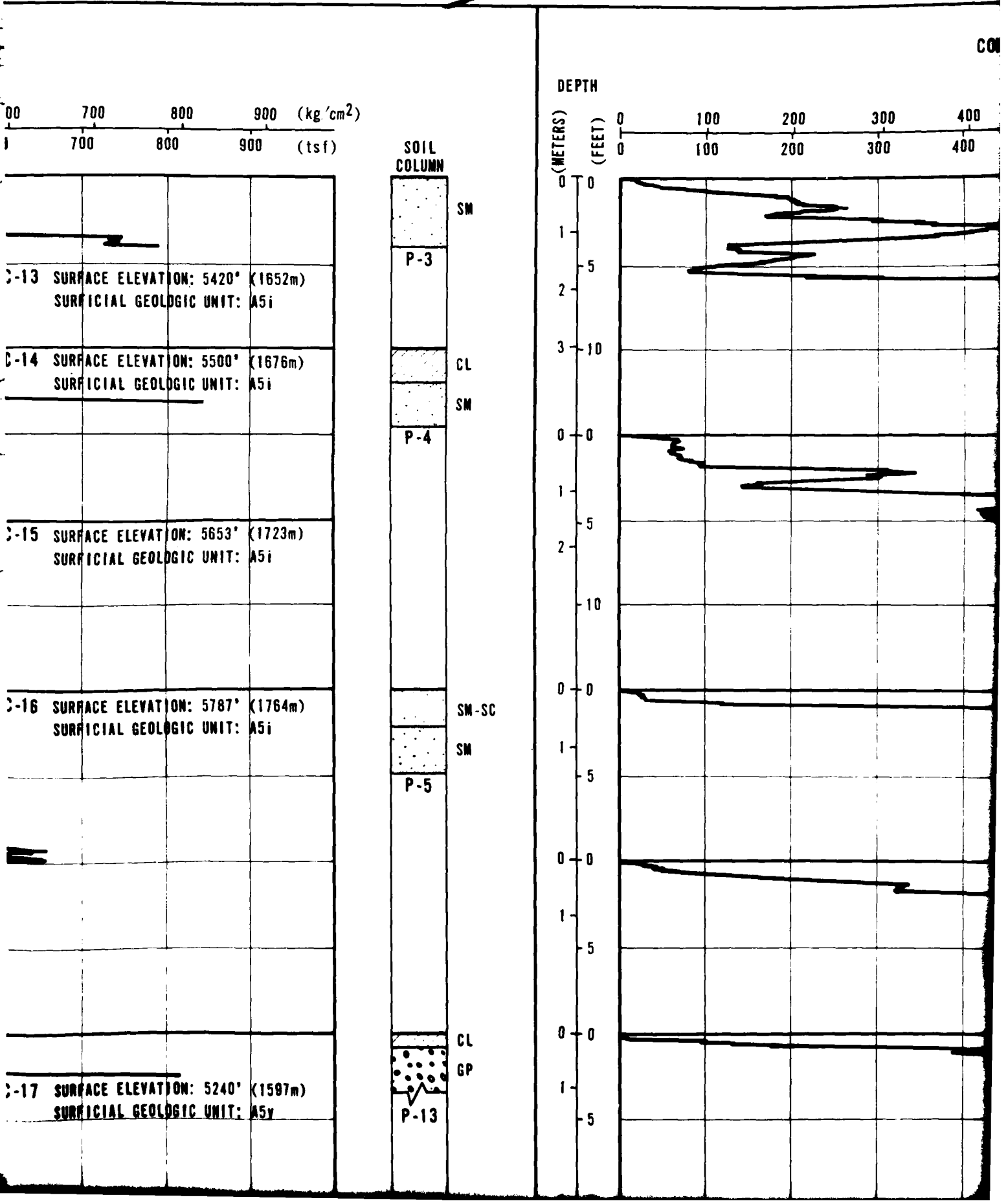
FN-TR-27-11


CONE RESISTANCE
DEPTH
(METERS)
(FEET)
0
100
200
300
400
500
600
700
800
C-1 SURFACE ELEVATION: 4723'
SURFICIAL GEOLOGIC UNIT:
C-2 SURFACE ELEVATION: 4790'
SURFICIAL GEOLOGIC UNIT:
C-3 SURFACE ELEVATION: 4840'
SURFICIAL GEOLOGIC UNIT:
C-4 SURFACE ELEVATION: 4911'
SURFICIAL GEOLOGIC UNIT:
C-5 SURFACE ELEVATION: 4900'
SURFICIAL GEOLOGIC UNIT:

1

2


CONE RESISTANCE
DEPTH
(METERS)
(FEET)
0 100 200 300 400 500
0 100 200 300 400 500
00 800 900 (kg/cm2)
800 900 (tsf)
SOIL COLUMN
CE ELEVATION: 4723' (1440m)
CIAL GEOLOGIC UNIT: A4o
CE ELEVATION: 4790' (1460m)
CIAL GEOLOGIC UNIT: A4o A5y
CE ELEVATION: 4840' (1475m)
CIAL GEOLOGIC UNIT: A4o
CE ELEVATION: 4911' (1497m)
CIAL GEOLOGIC UNIT: A4o
CE ELEVATION: 4908' (1496m)
CIAL GEOLOGIC UNIT: A1
SM
SC
CS-1
SM
SP
GP
SM
P-8
CL
CS-3
CL
GM
P-7



C-13 SURFACE ELEVATION: 5420' (1652m)
SURFICIAL GEOLOGIC UNIT: A5i

C-14 SURFACE ELEVATION: 5500' (1676m)
SURFICIAL GEOLOGIC UNIT: A5i

C-15 SURFACE ELEVATION: 5653' (1723m)
SURFICIAL GEOLOGIC UNIT: A5i

C-16 SURFACE ELEVATION: 5787' (1764m)
SURFICIAL GEOLOGIC UNIT: A5i

C-17 SURFACE ELEVATION: 5240' (1597m)
SURFICIAL GEOLOGIC UNIT: A5y

CONE RESISTANCE

200 300 400 500 600 700 800 900 (kg/cm^2)

200 300 400 500 600 700 800 900 (tsf)

C-27 SURFACE ELEVATION: 5340' (1628m)
SURFICIAL GEOLOGIC UNIT: A5i

C-28 SURFACE ELEVATION: 5480' (1670m)
SURFICIAL GEOLOGIC UNIT: A5i

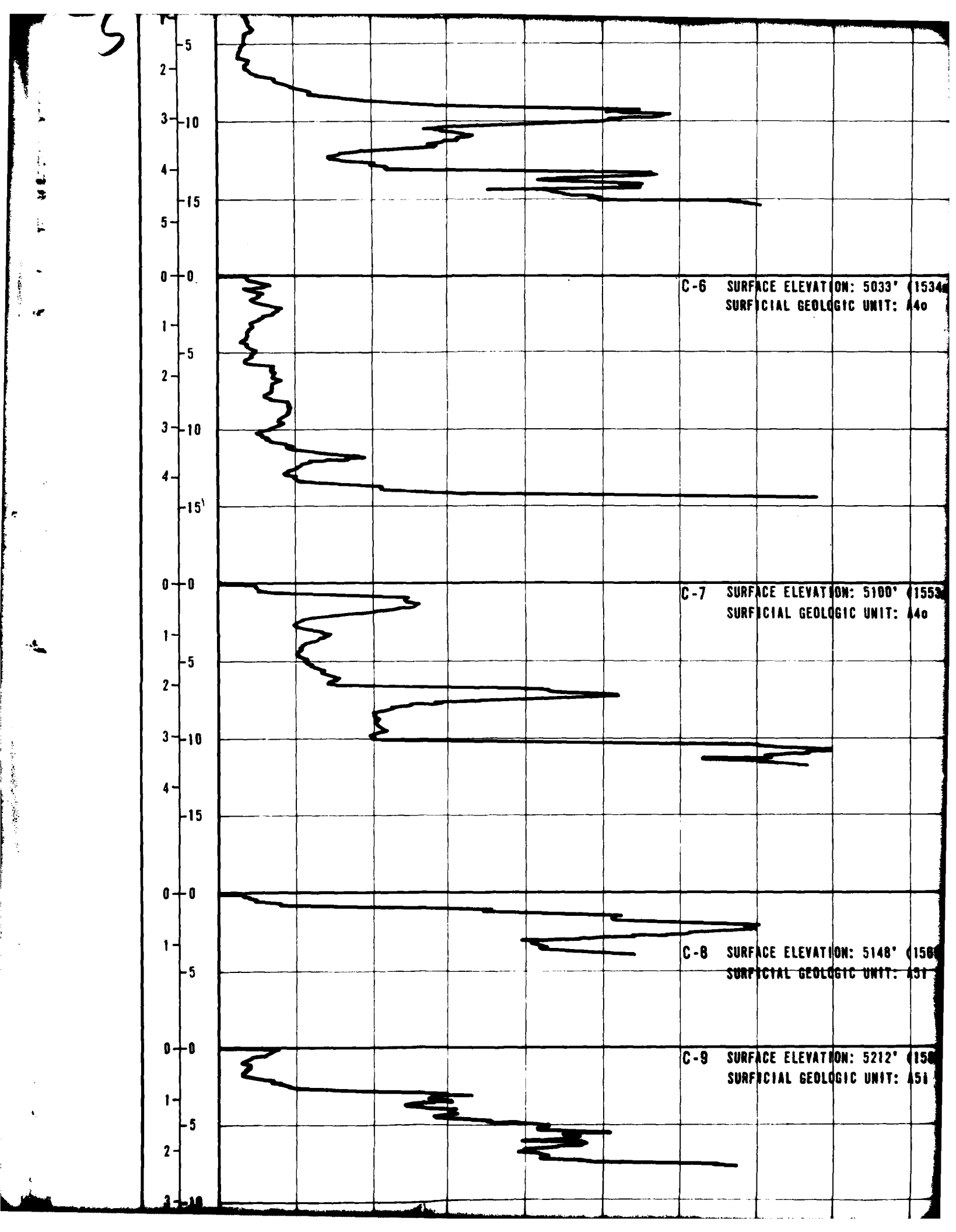
C-29 SURFACE ELEVATION: 5207' (1587m)
SURFICIAL GEOLOGIC UNIT: A5i

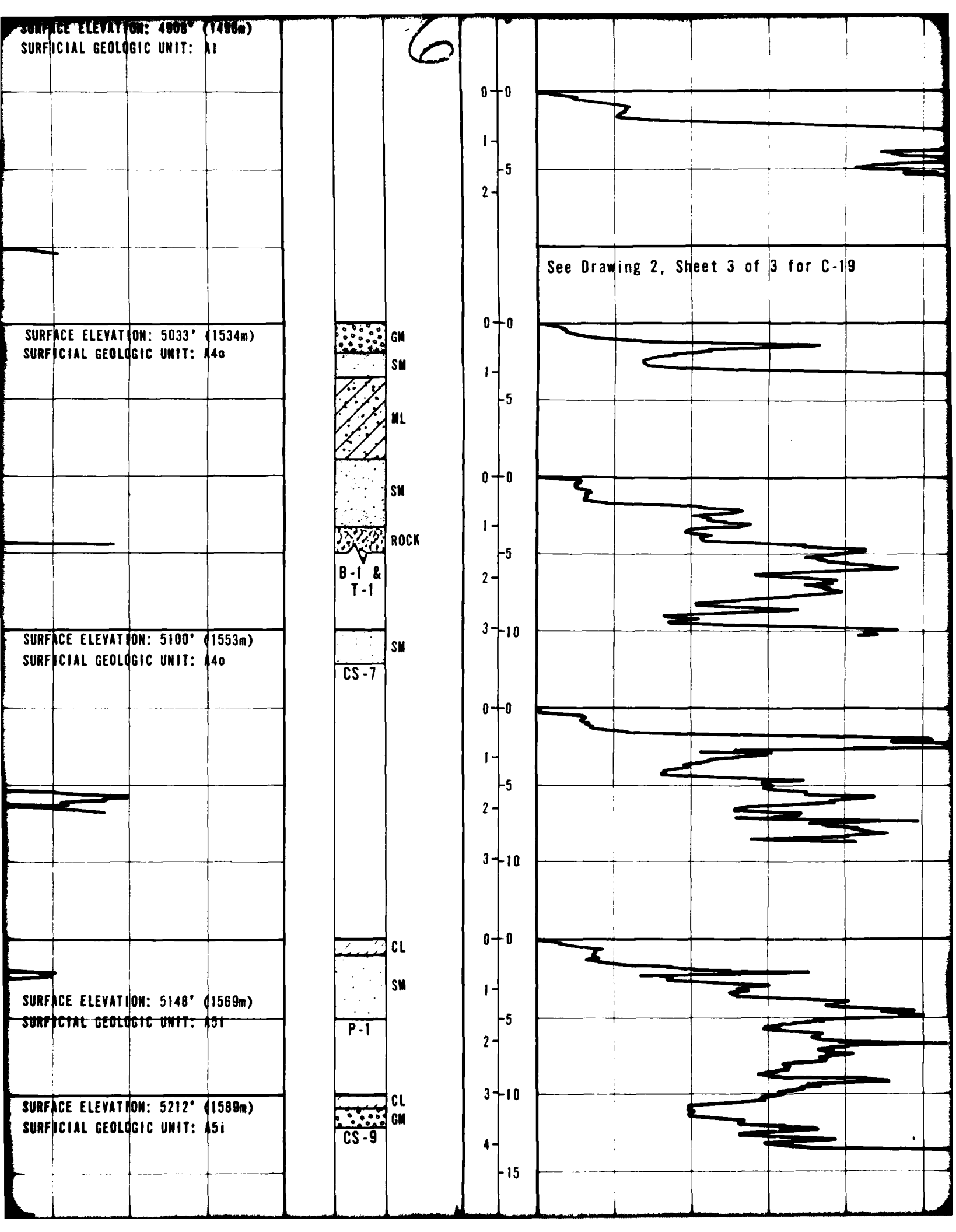
C-30 SURFACE ELEVATION: 5273' (1607m)
SURFICIAL GEOLOGIC UNIT: A5i

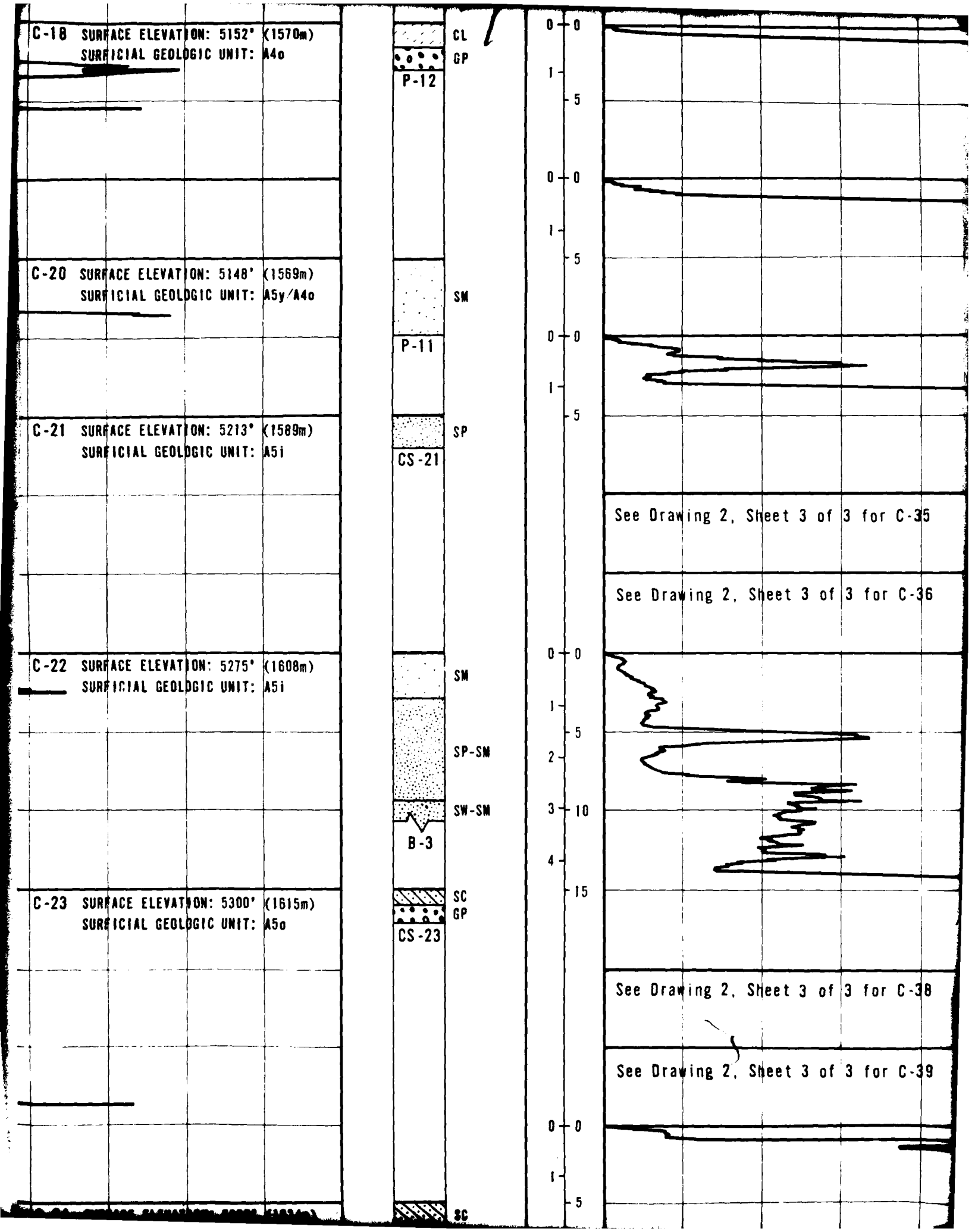
C-31 SURFACE ELEVATION: 5353' (1632m)
SURFICIAL GEOLOGIC UNIT: A5i

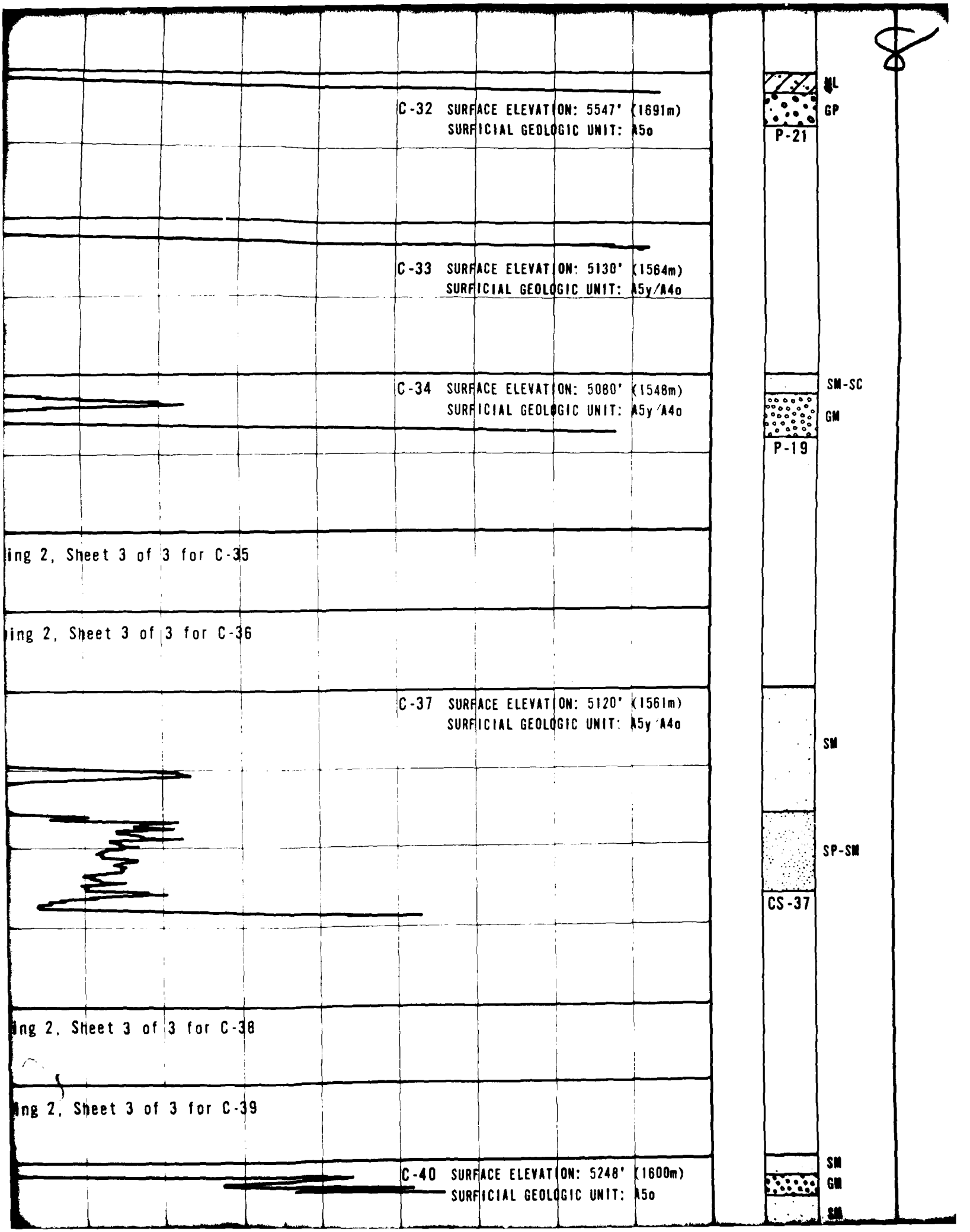
SOIL COLUMN

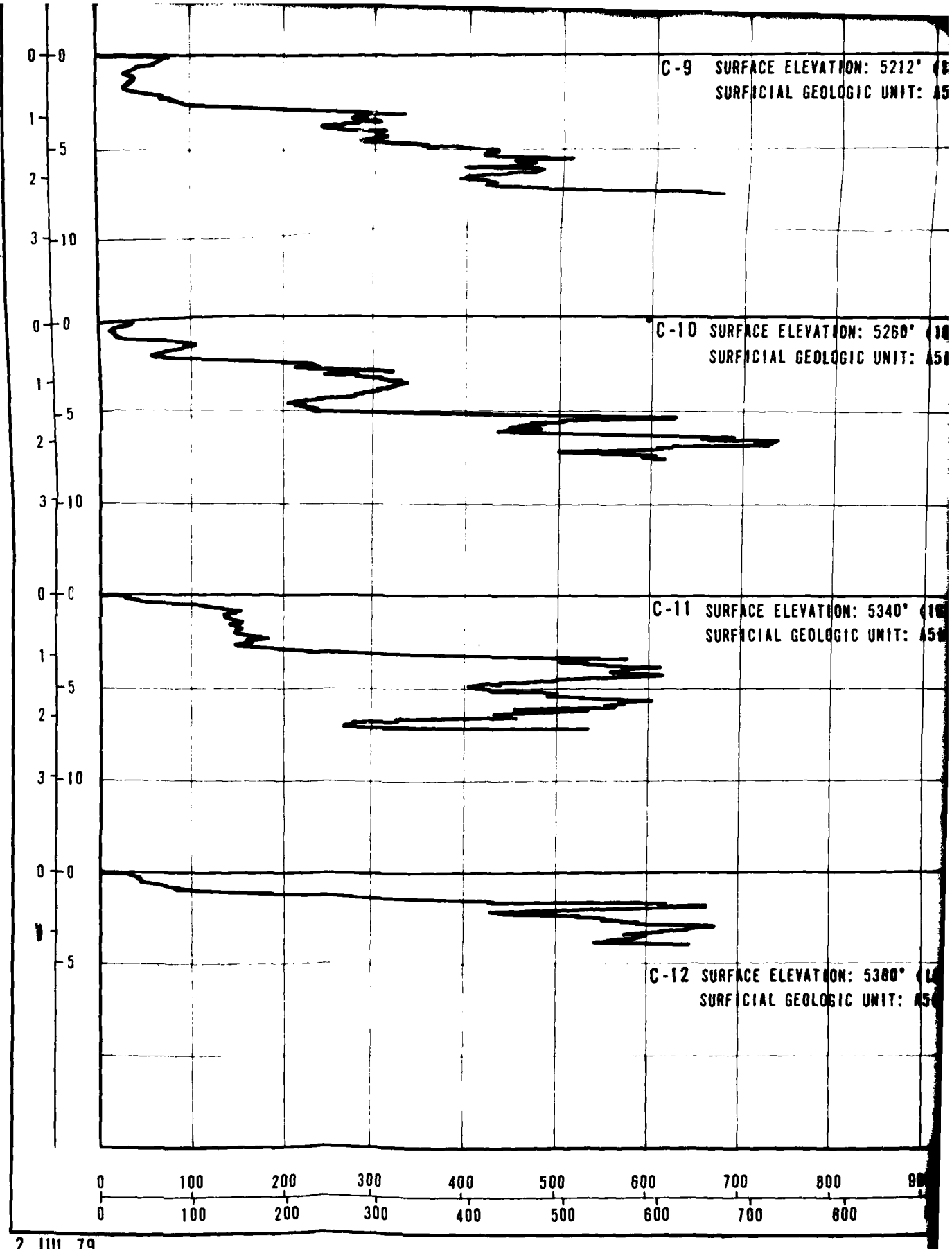
CL
GP
CS-27
CL
GP-GM
P-15
SC
GP
P-20


C-6 SURFACE ELEVATION: 5033' (1534
SURFICIAL GEOLOGIC UNIT: A4o
C-7 SURFACE ELEVATION: 5100' (1553
SURFICIAL GEOLOGIC UNIT: A4o
C-8 SURFACE ELEVATION: 5148' (150
SURFICIAL GEOLOGIC UNIT: A5
C-9 SURFACE ELEVATION: 5212' (150
SURFICIAL GEOLOGIC UNIT: A5


SURFACE ELEVATION: 4908' (1496m)
SURFICIAL GEOLOGIC UNIT: A1
See Drawing 2, Sheet 3 of 3 for C-19
SURFACE ELEVATION: 5033' (1534m)
SURFICIAL GEOLOGIC UNIT: A4o
GM
SM
ML
SM
ROCK
B-1 & T-1
SURFACE ELEVATION: 5100' (1553m)
SURFICIAL GEOLOGIC UNIT: A4o
SM
CS-7
CL
SM
SURFACE ELEVATION: 5148' (1569m)
SURFICIAL GEOLOGIC UNIT: A5i
P-1
CL
SURFACE ELEVATION: 5212' (1589m)
SURFICIAL GEOLOGIC UNIT: A5i
GM
CS-9
0 0
1 5
2
0 0
1 5
0 0
1 5
2
3 10
0 0
1 5
2
3 10
0 0
1 5
2
3 10
4
15


C-18 SURFACE ELEVATION: 5152' (1570m)
SURFICIAL GEOLOGIC UNIT: A4o
C-20 SURFACE ELEVATION: 5148' (1569m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o
C-21 SURFACE ELEVATION: 5213' (1589m)
SURFICIAL GEOLOGIC UNIT: A5i
C-22 SURFACE ELEVATION: 5275' (1608m)
SURFICIAL GEOLOGIC UNIT: A5i
C-23 SURFACE ELEVATION: 5300' (1615m)
SURFICIAL GEOLOGIC UNIT: A5o
CL
GP
P-12
SM
P-11
SP
CS-21
SM
SP-SM
SW-SM
B-3
SC
GP
CS-23
SC
0 0
1 5
0 0
1 5
0 0
1 5
0 0
1 5
2 10
3 10
4 15
0 0
1 5
See Drawing 2, Sheet 3 of 3 for C-35
See Drawing 2, Sheet 3 of 3 for C-36
See Drawing 2, Sheet 3 of 3 for C-38
See Drawing 2, Sheet 3 of 3 for C-39


C-32 SURFACE ELEVATION: 5547' (1691m)
SURFICIAL GEOLOGIC UNIT: A5o
C-33 SURFACE ELEVATION: 5130' (1564m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o
C-34 SURFACE ELEVATION: 5080' (1548m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o
ing 2, Sheet 3 of 3 for C-35
ing 2, Sheet 3 of 3 for C-36
C-37 SURFACE ELEVATION: 5120' (1561m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o
ng 2, Sheet 3 of 3 for C-38
ng 2, Sheet 3 of 3 for C-39
C-40 SURFACE ELEVATION: 5248' (1600m)
SURFICIAL GEOLOGIC UNIT: A5o
ML
GP
P-21
SM-SC
GM
P-19
SM
SP-SM
CS-37
SM
GM
SM



CHECKED BY _____ APPROVED BY _____

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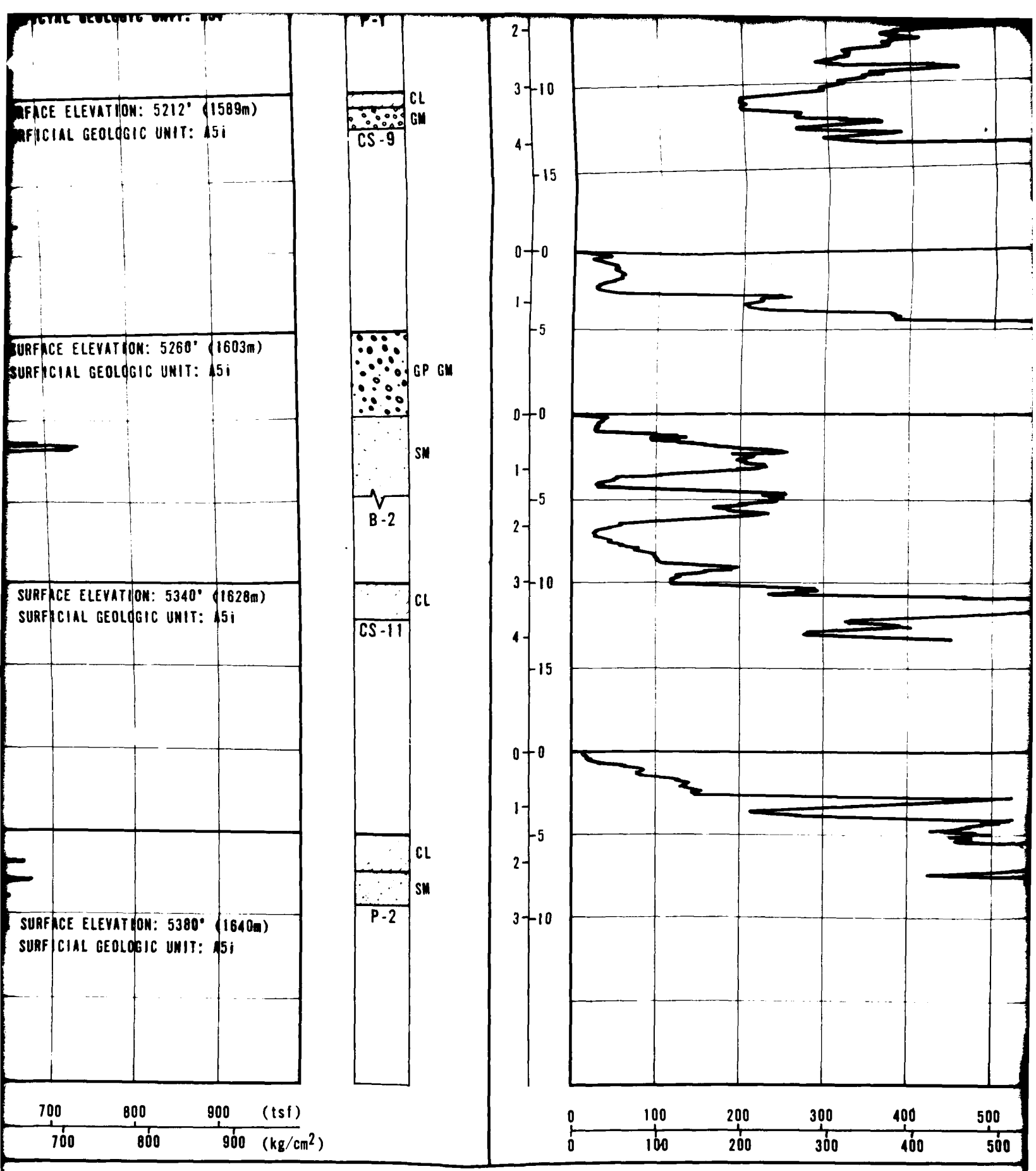
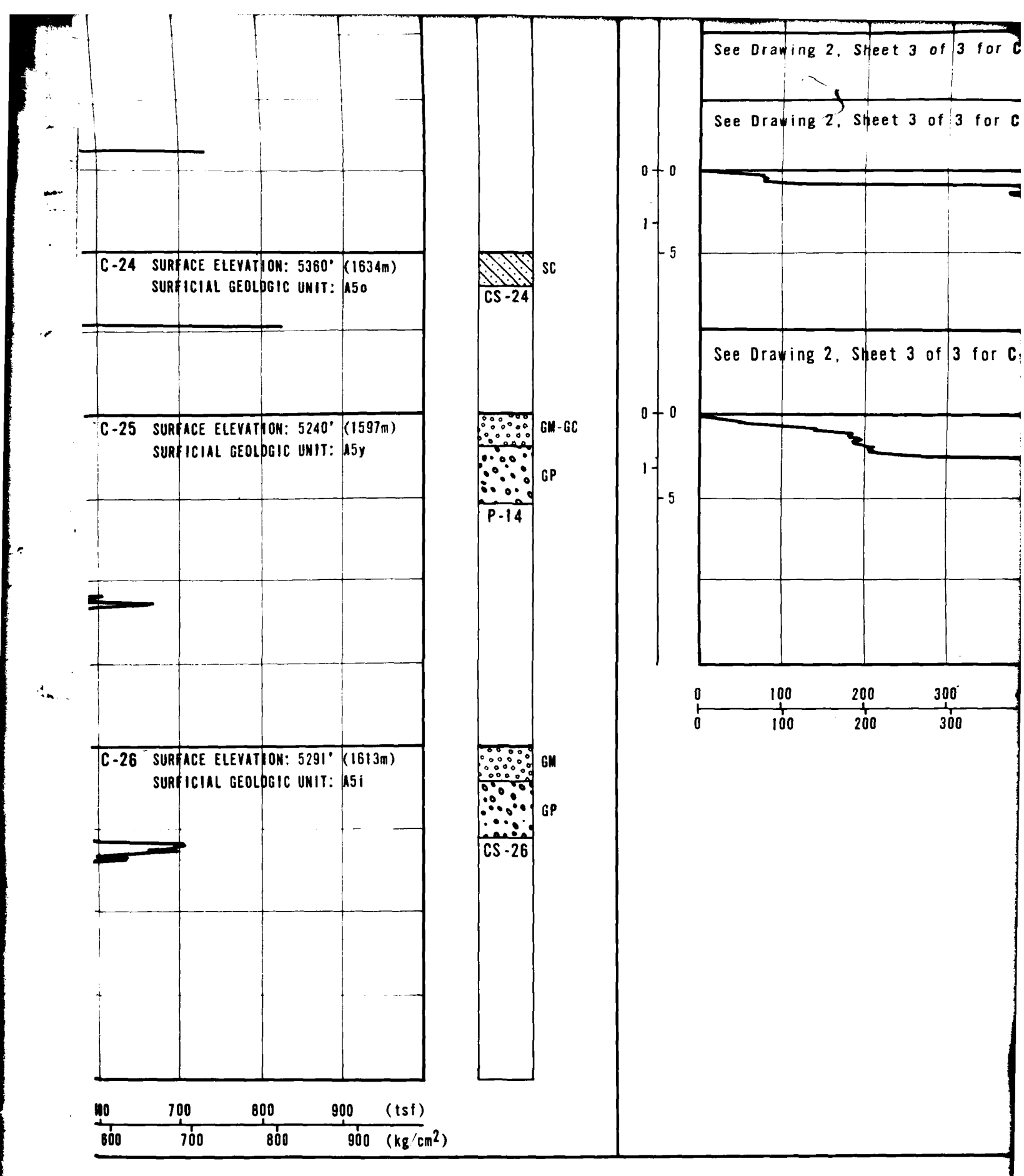
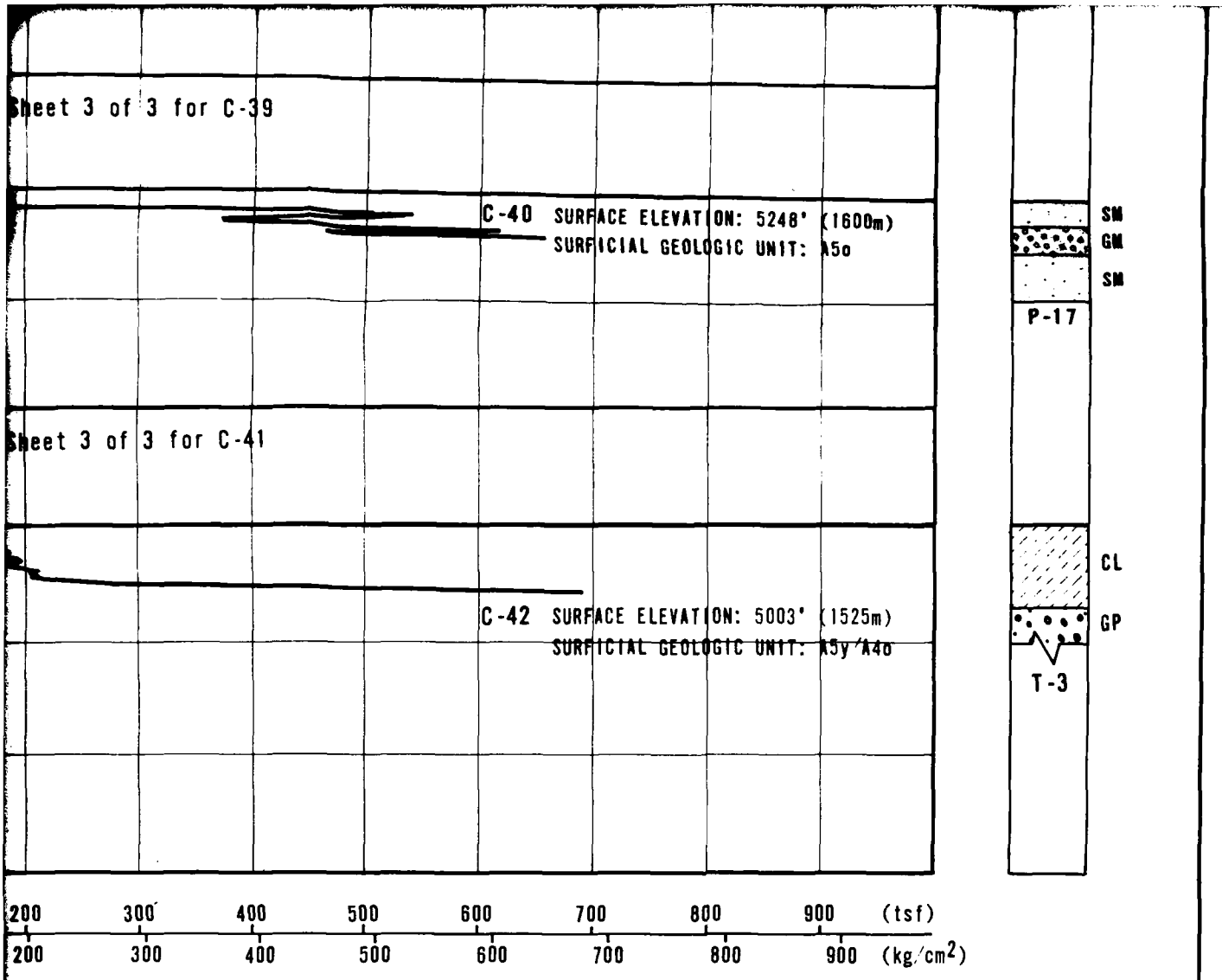

RFACE ELEVATION: 5212' (1589m)
RFICIAL GEOLOGIC UNIT: A5i
URFACE ELEVATION: 5260' (1603m)
URFICIAL GEOLOGIC UNIT: A5i
SURFACE ELEVATION: 5340' (1628m)
SURFICIAL GEOLOGIC UNIT: A5i
SURFACE ELEVATION: 5380' (1640m)
SURFICIAL GEOLOGIC UNIT: A5i
P-1
CL
GM
CS-9
GP GM
SM
B-2
CL
CS-11
CL
SM
P-2
700 800 900 (tsf)
700 800 900 (kg/cm2)
0 100 200 300 400 500
0 100 200 300 400 500


See Drawing 2, Sheet 3 of 3 for C
See Drawing 2, Sheet 3 of 3 for C
See Drawing 2, Sheet 3 of 3 for C
C-24 SURFACE ELEVATION: 5360' (1634m)
SURFICIAL GEOLOGIC UNIT: A5o
C-25 SURFACE ELEVATION: 5240' (1597m)
SURFICIAL GEOLOGIC UNIT: A5y
C-26 SURFACE ELEVATION: 5291' (1613m)
SURFICIAL GEOLOGIC UNIT: A5i
SC
CS-24
GM-GC
GP
P-14
GM
GP
CS-26
0
0
1
5
0
0
1
5
0
100
200
300
0
100
200
300
600
700
800
900 (tsf)
600
700
800
900 (kg/cm²)



CONE PENETROMETER TEST RESULTS
VERIFICATION SITE
WHIRLWIND CDP, UTAH

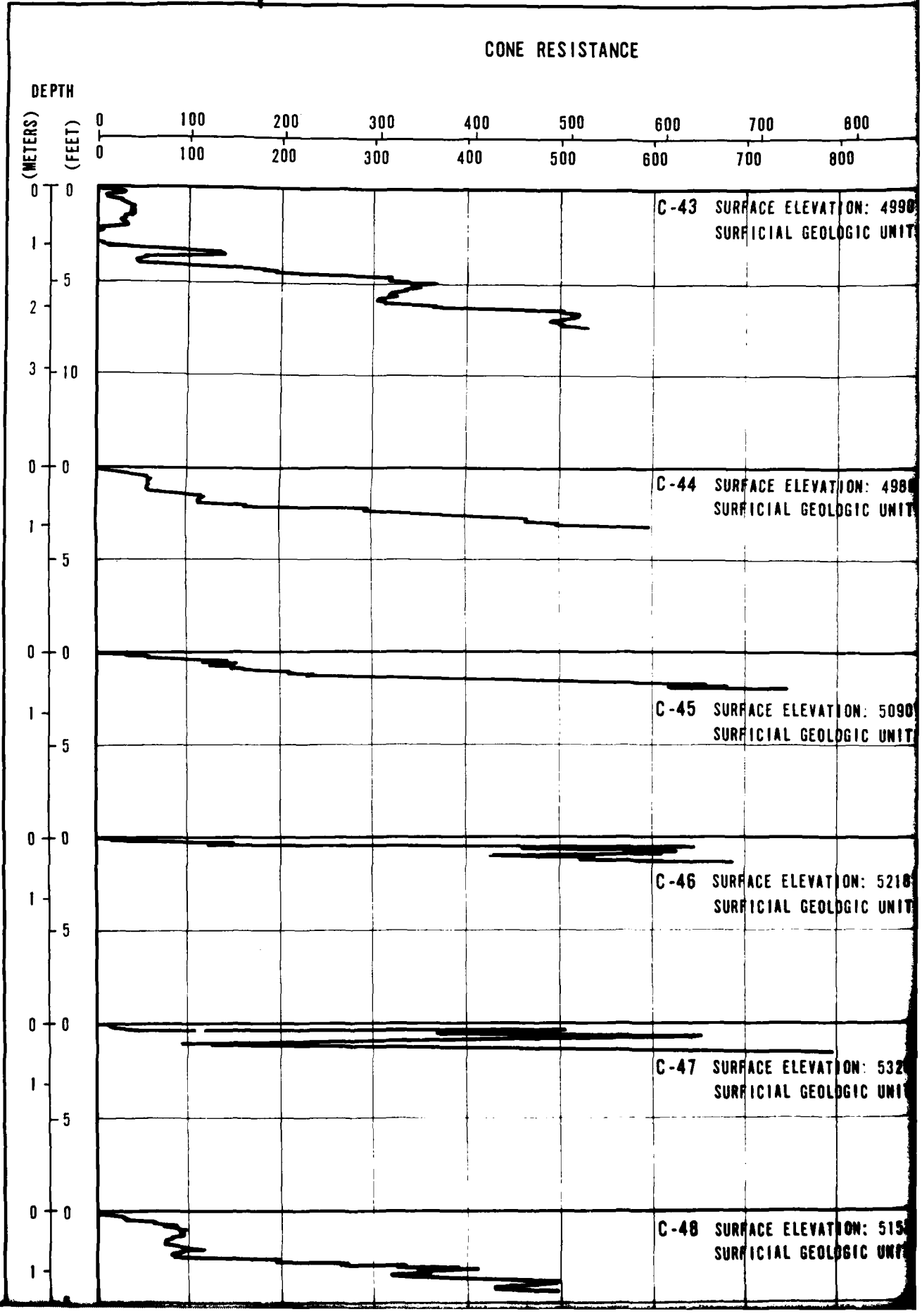
MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - SAMSO

DRAWING
2
OF 3

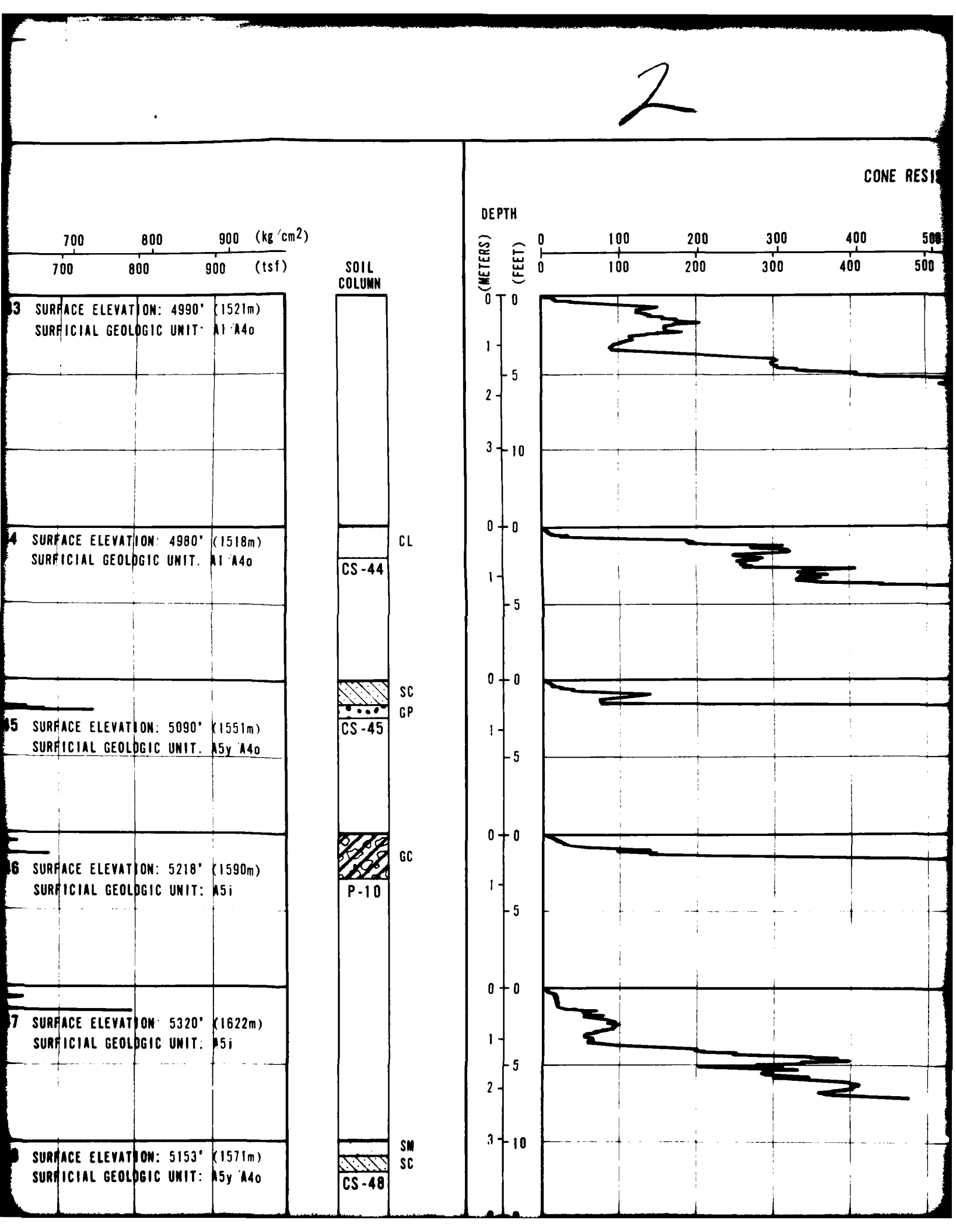
FUGRO NATIONAL, INC.

12

FN-TR-27-11


CONE RESISTANCE
DEPTH
(METERS)
(FEET)
0
100
200
300
400
500
600
700
800
C-43 SURFACE ELEVATION: 4990
SURFICIAL GEOLOGIC UNIT
C-44 SURFACE ELEVATION: 498
SURFICIAL GEOLOGIC UNIT
C-45 SURFACE ELEVATION: 5090
SURFICIAL GEOLOGIC UNIT
C-46 SURFACE ELEVATION: 5218
SURFICIAL GEOLOGIC UNIT
C-47 SURFACE ELEVATION: 532
SURFICIAL GEOLOGIC UNI
C-48 SURFACE ELEVATION: 515
SURFICIAL GEOLOGIC UNI

2


700 800 900 (kg/cm2)
700 800 900 (tsf)
SOIL COLUMN
3 SURFACE ELEVATION: 4990' (1521m)
SURFICIAL GEOLOGIC UNIT: A1 A4o
4 SURFACE ELEVATION: 4980' (1518m)
SURFICIAL GEOLOGIC UNIT. A1 A4o
CL
CS-44
SC
GP
5 SURFACE ELEVATION: 5090' (1551m)
SURFICIAL GEOLOGIC UNIT. A5y A4o
CS-45
GC
6 SURFACE ELEVATION: 5218' (1590m)
SURFICIAL GEOLOGIC UNIT: A5i
P-10
7 SURFACE ELEVATION: 5320' (1622m)
SURFICIAL GEOLOGIC UNIT: A5i
SM
SC
SURFACE ELEVATION: 5153' (1571m)
SURFICIAL GEOLOGIC UNIT: A5y A4o
CS-48
CONE RESI
DEPTH
(METERS)
(FEET)
0 100 200 300 400 500
0 100 200 300 400 500
0 1 2 3
0 5 10

3

CE

600 700 800 900 (kg/cm²)

600 700 800 900 (tsf)

C-58 SURFACE ELEVATION: 5293' (1613m)
SURFICIAL GEOLOGIC UNIT: A5y

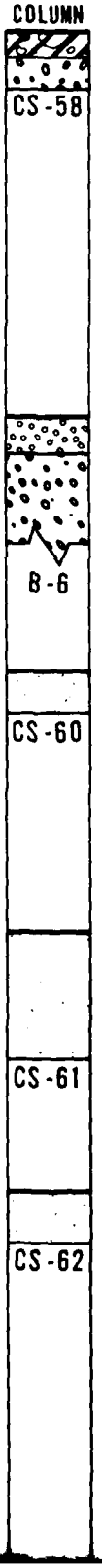
C-59 SURFACE ELEVATION: 5058' (1542m)
SURFICIAL GEOLOGIC UNIT A5y/A4o

C-60 SURFACE ELEVATION: 4883' (1488m)
SURFICIAL GEOLOGIC UNIT: A5y A4o

C-61 SURFACE ELEVATION: 4892' (1491m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o

C-62 SURFACE ELEVATION: 4850' (1478m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o

SOIL COLUMN



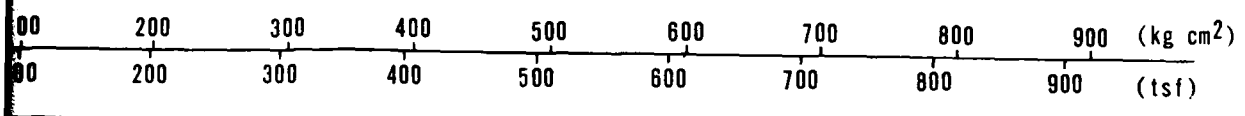
DEPTH

(METERS) 0 100 200 300

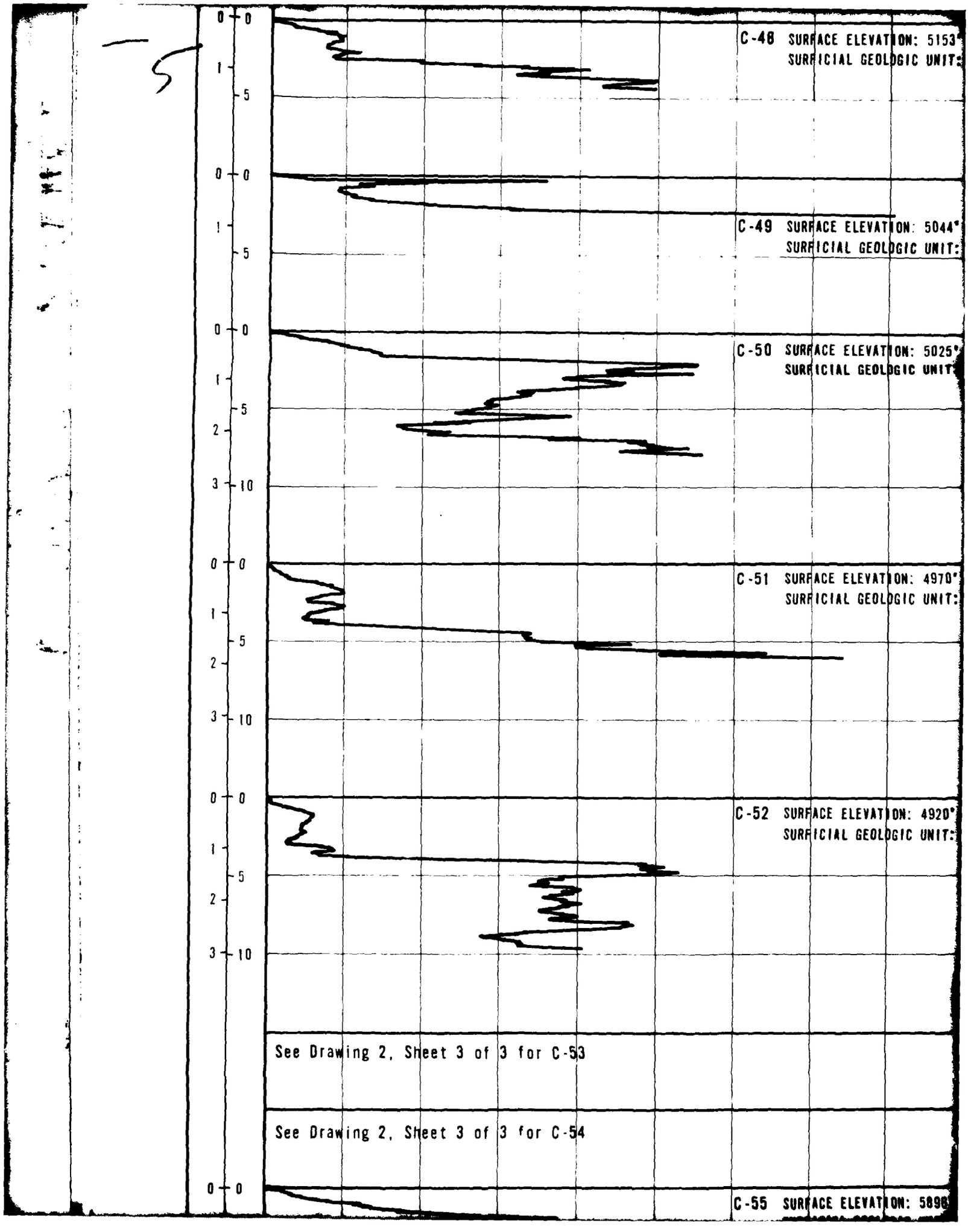
(FEET) 0 100 200 300

4

CONE RESISTANCE



SOIL COLUMN


C-48 SURFACE ELEVATION: 5153'
SURFICIAL GEOLOGIC UNIT:
C-49 SURFACE ELEVATION: 5044'
SURFICIAL GEOLOGIC UNIT:
C-50 SURFACE ELEVATION: 5025'
SURFICIAL GEOLOGIC UNIT:
C-51 SURFACE ELEVATION: 4970'
SURFICIAL GEOLOGIC UNIT:
C-52 SURFACE ELEVATION: 4920'
SURFICIAL GEOLOGIC UNIT:
See Drawing 2, Sheet 3 of 3 for C-53
See Drawing 2, Sheet 3 of 3 for C-54
C-55 SURFACE ELEVATION: 5898'

48 SURFACE ELEVATION: 5153' (1571m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o

49 SURFACE ELEVATION: 5044' (1537m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o

50 SURFACE ELEVATION: 5025' (1532m)
SURFICIAL GEOLOGIC UNIT: A4o/A5i

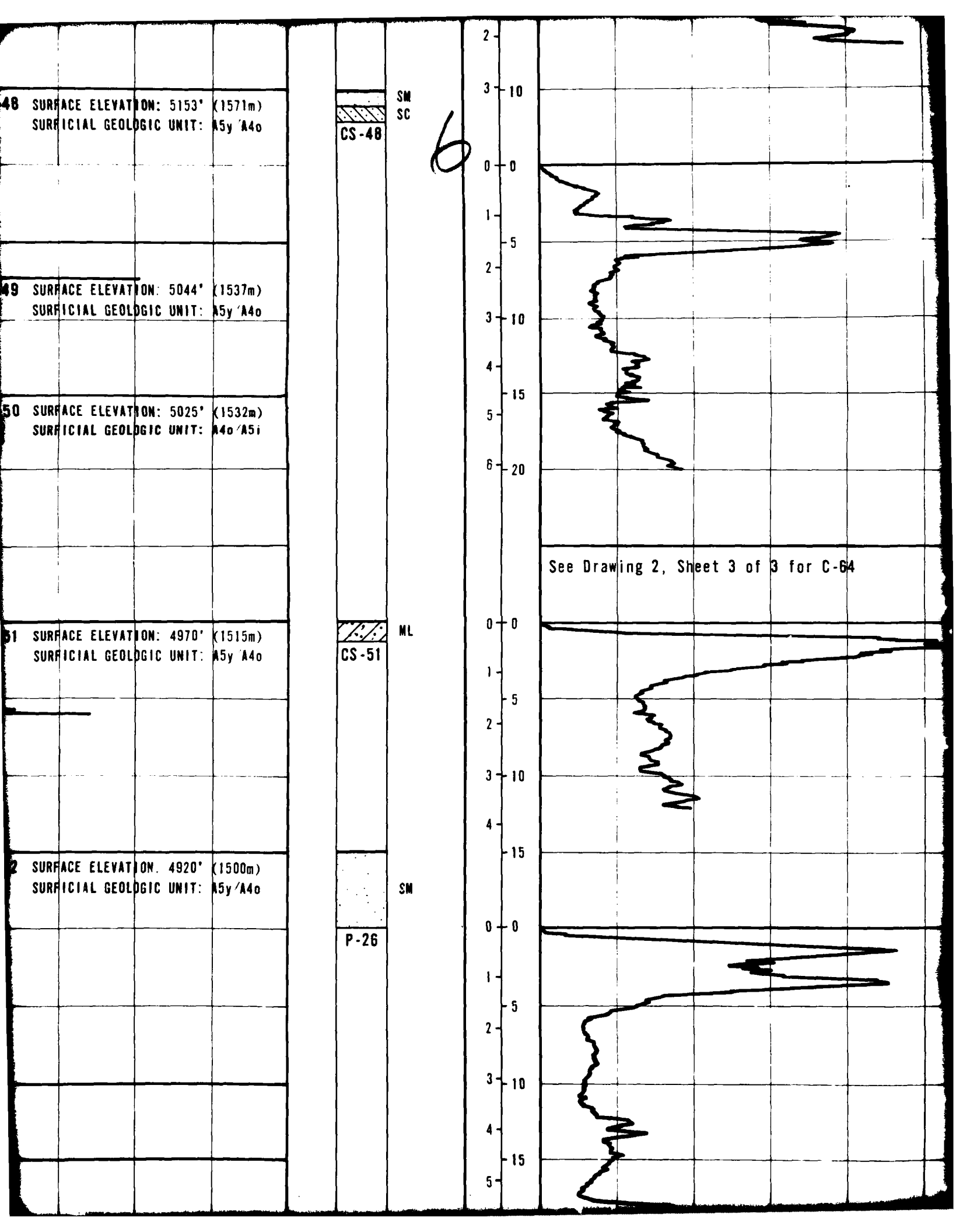
51 SURFACE ELEVATION: 4970' (1515m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o

2 SURFACE ELEVATION: 4920' (1500m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o

SM
SC
CS-48

ML
CS-51

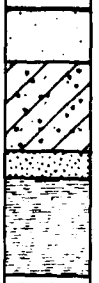
SM
P-26



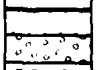
See Drawing 2, Sheet 3 of 3 for C-64

1

C-63 SURFACE ELEVATION: 4785' (1458m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o

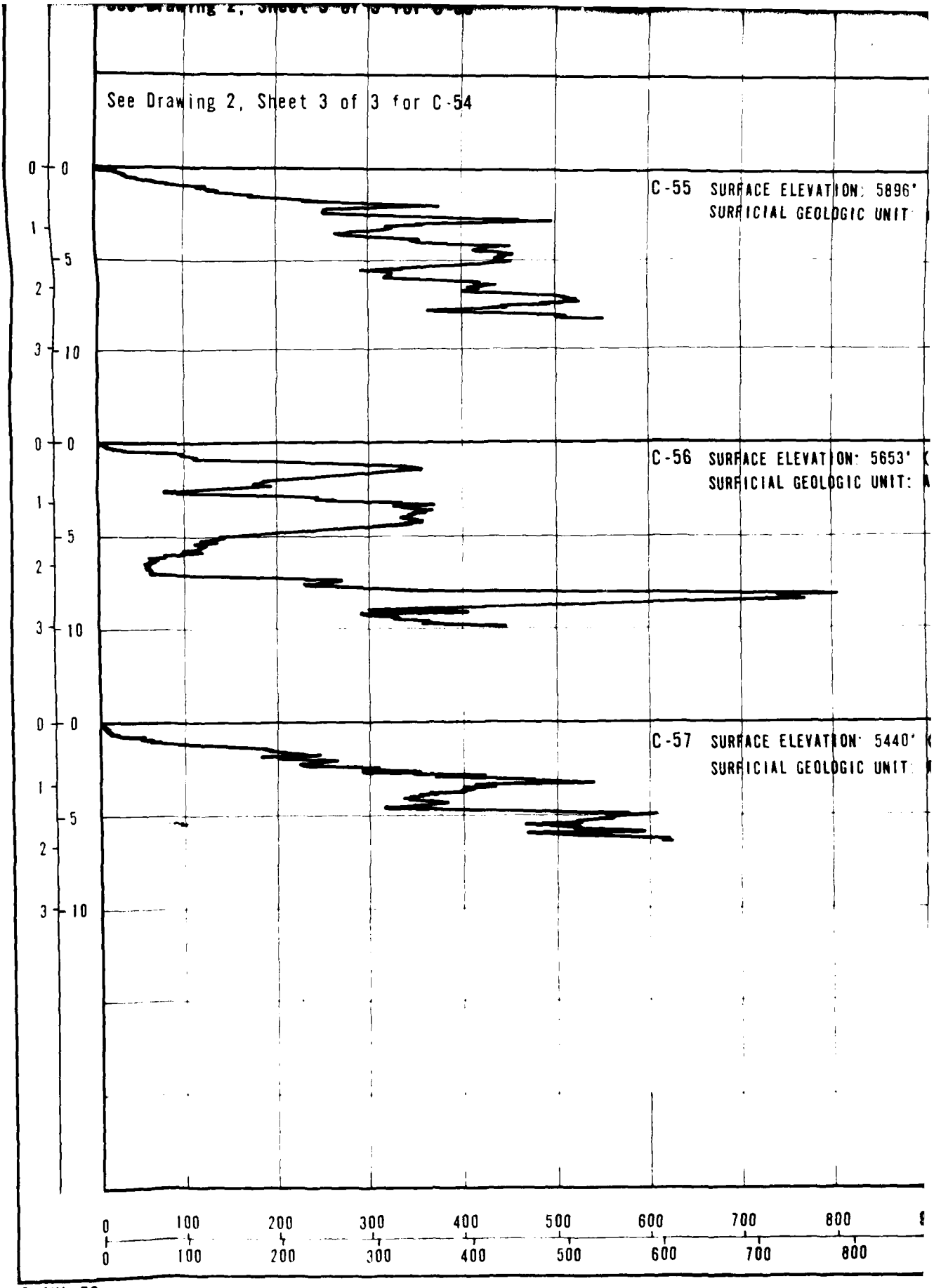


C-65 SURFACE ELEVATION: 4650' (1417m)
SURFICIAL GEOLOGIC UNIT: A4o

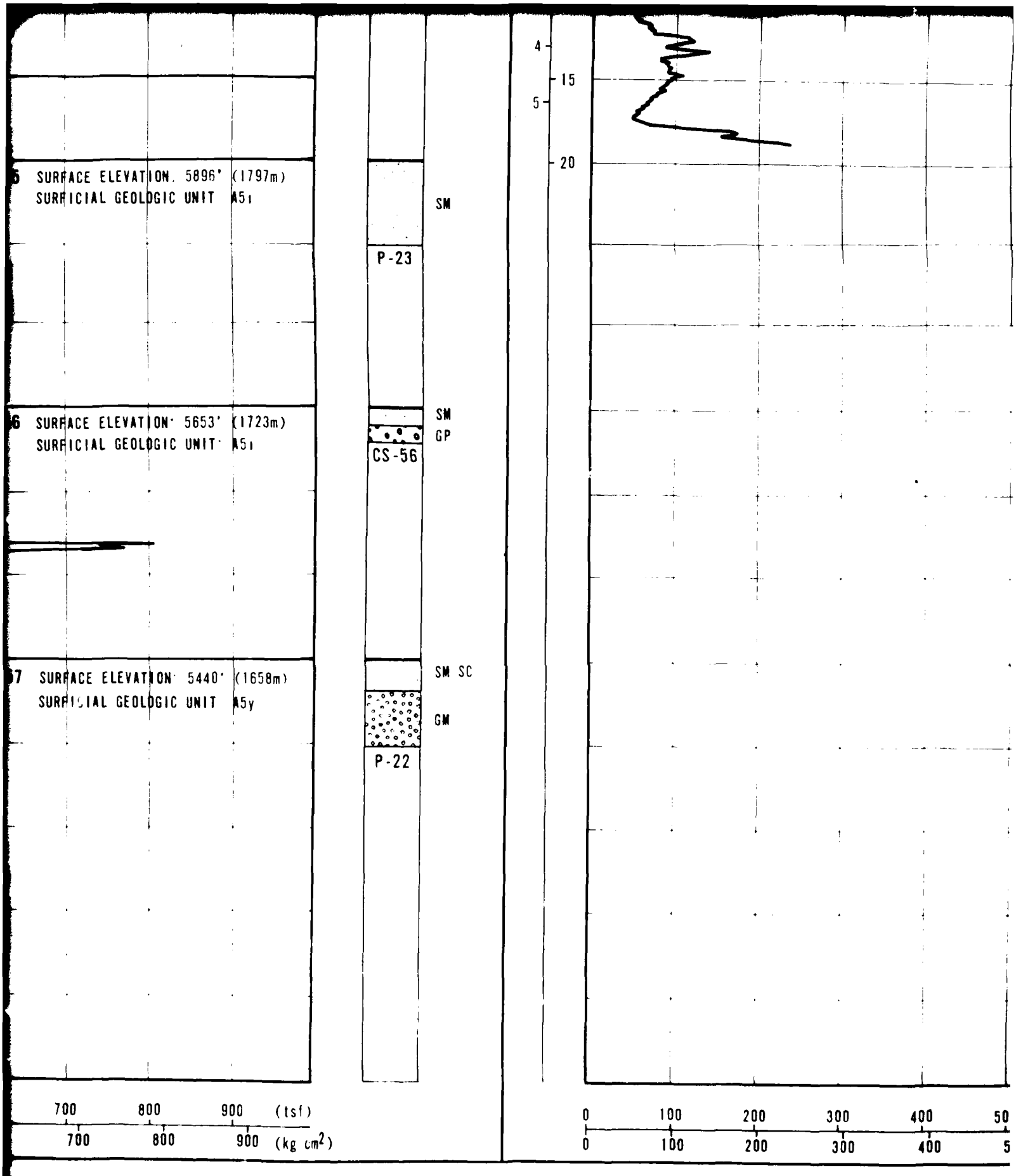


C-66 SURFACE ELEVATION: 4543' (1385m)
SURFICIAL GEOLOGIC UNIT: A4o

8


See Drawing 2, Sheet 3 of 3 for C-54
C-55 SURFACE ELEVATION: 5896'
SURFICIAL GEOLOGIC UNIT
C-56 SURFACE ELEVATION: 5653'
SURFICIAL GEOLOGIC UNIT:
C-57 SURFACE ELEVATION: 5440'
SURFICIAL GEOLOGIC UNIT
0 0
1 5
2 10
3
0 100 200 300 400 500 600 700 800
APPROVED BY
CHECKED BY
2 JUL 79

9


5 SURFACE ELEVATION. 5896' (1797m)
SURFICIAL GEOLOGIC UNIT A5i
SM
P-23
6 SURFACE ELEVATION. 5653' (1723m)
SURFICIAL GEOLOGIC UNIT A5i
SM
GP
CS-56
7 SURFACE ELEVATION. 5440' (1658m)
SURFICIAL GEOLOGIC UNIT A5y
SM SC
GM
P-22
4
15
5
20
700 800 900 (tsf)
700 800 900 (kg cm²)
0 100 200 300 400 50
0 100 200 300 400 5

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AUG 79 F04704-78-C-0027
UNCLASSIFIED FN-TR-27-VOL-2 NL

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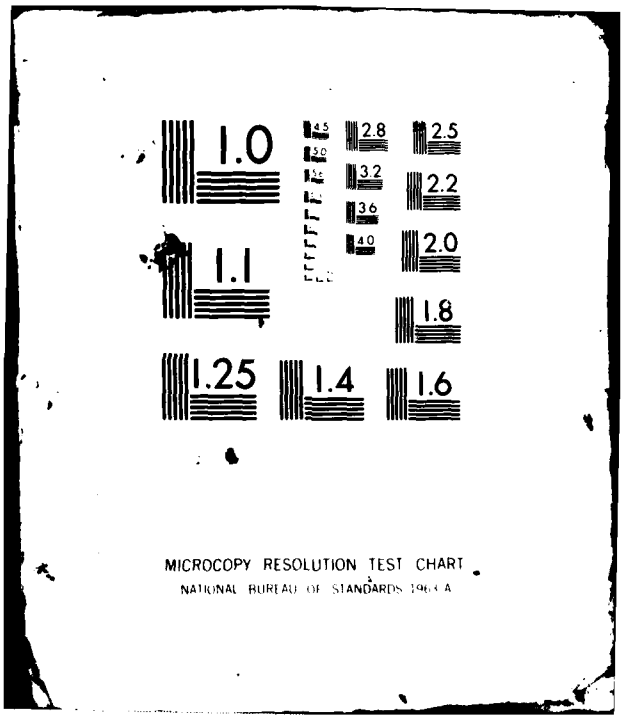
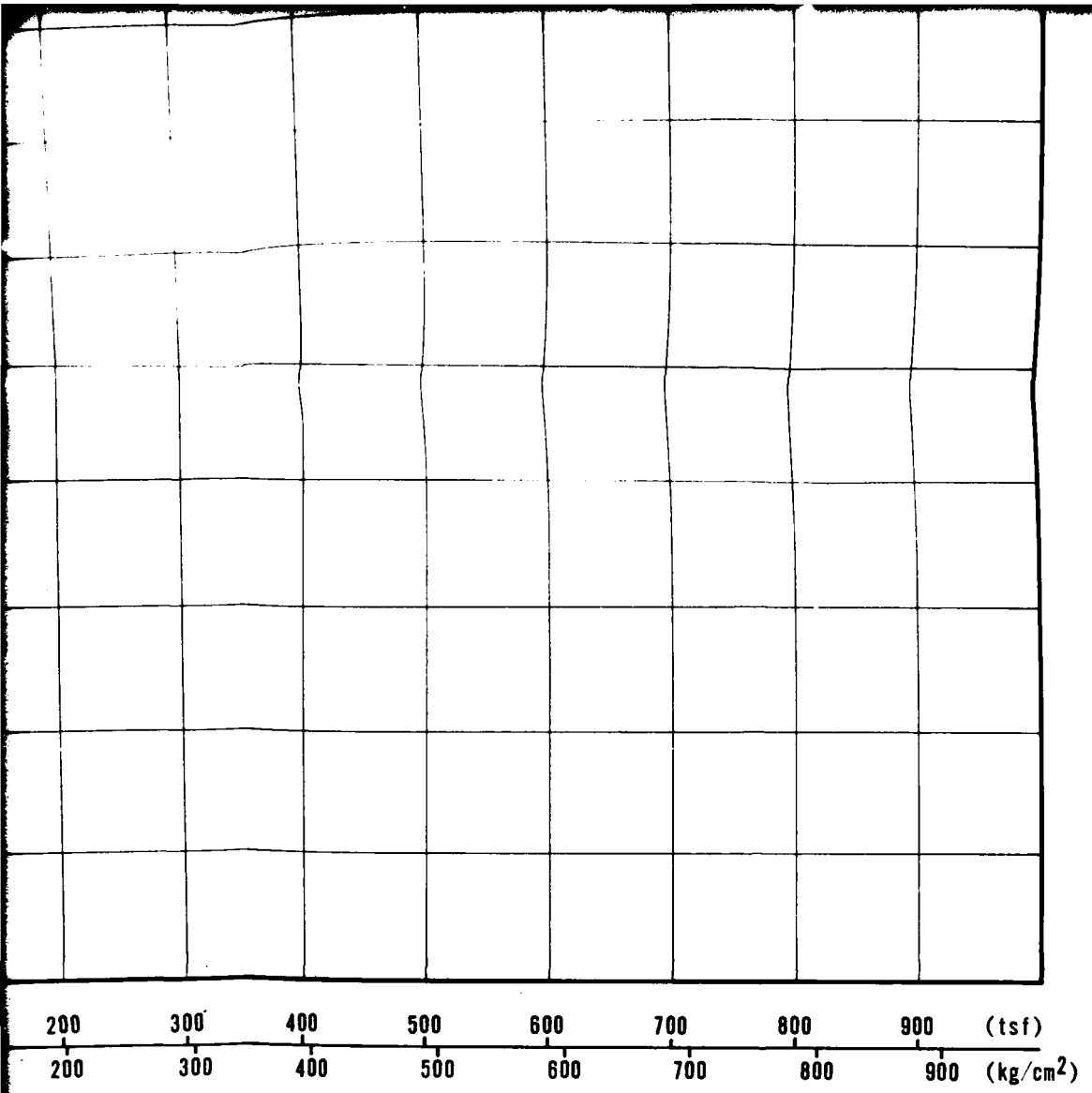
END
DATE FILMED
5 82
DTIC


1.0
1.1
1.25
1.4
1.6
2.8
3.2
3.6
4.0
2.5
2.2
2.0
1.8
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS 1963 A

0
100
200
300
0
100
200
300
600
700
800
900
(tsf)
600
700
800
900
(kg/cm2)



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VERIFICATION SITE
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DEPARTMENT OF THE AIR FORCE - SAMSO

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2
2 OF 3

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12

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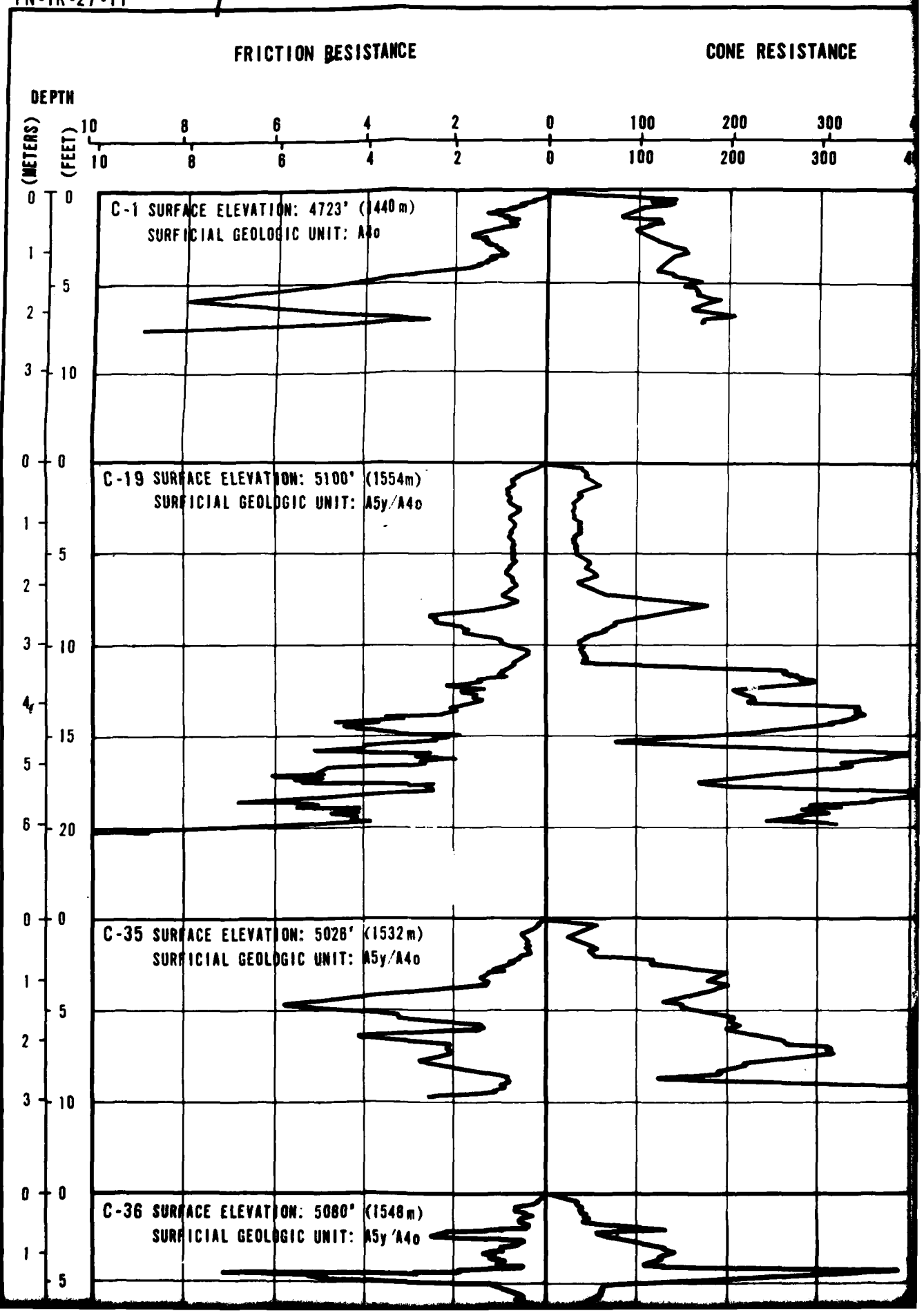

FRICTION RESISTANCE
CONE RESISTANCE
DEPTH
(METERS)
(FEET)
10 8 6 4 2 0
100 200 300
C-1 SURFACE ELEVATION: 4723' (1440 m)
SURFICIAL GEOLOGIC UNIT: A4o
C-19 SURFACE ELEVATION: 5100' (1554m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o
C-35 SURFACE ELEVATION: 5028' (1532m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o
C-36 SURFACE ELEVATION: 5080' (1548m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o

1

2

CONE RESISTANCE

200 300 400 (kg/cm^2)

200 300 400 (tsf)

SOIL COLUMN

SM

CS-1

ML

CS-19

SW

SM

B-4

FRICTION RESISTANCE

DEPTH

(METERS) (FEET)

10 8 6 4 2 0

10 8 6 4 2 0

0 0

1 5

2 10

3

C-54 SURFACE ELEVATION: 4893' (1491m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o

0 0

1 5

C-63 SURFACE ELEVATION: 4785' (1458m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o

0 0

1 5

C-64 SURFACE ELEVATION: 4693' (1430m)
SURFICIAL GEOLOGIC UNIT: A4o

3

CONE RESISTANCE

100 200 300 400 (kg/cm²)

100 200 300 400 (tsf)

SOIL COLUMN

SM

P-24

SM

ML

P-25

CH

SM

SP-SM

CS-64

FRICTION RESISTANCE

DEPTH

(METERS) (FEET) 10 8 6 4

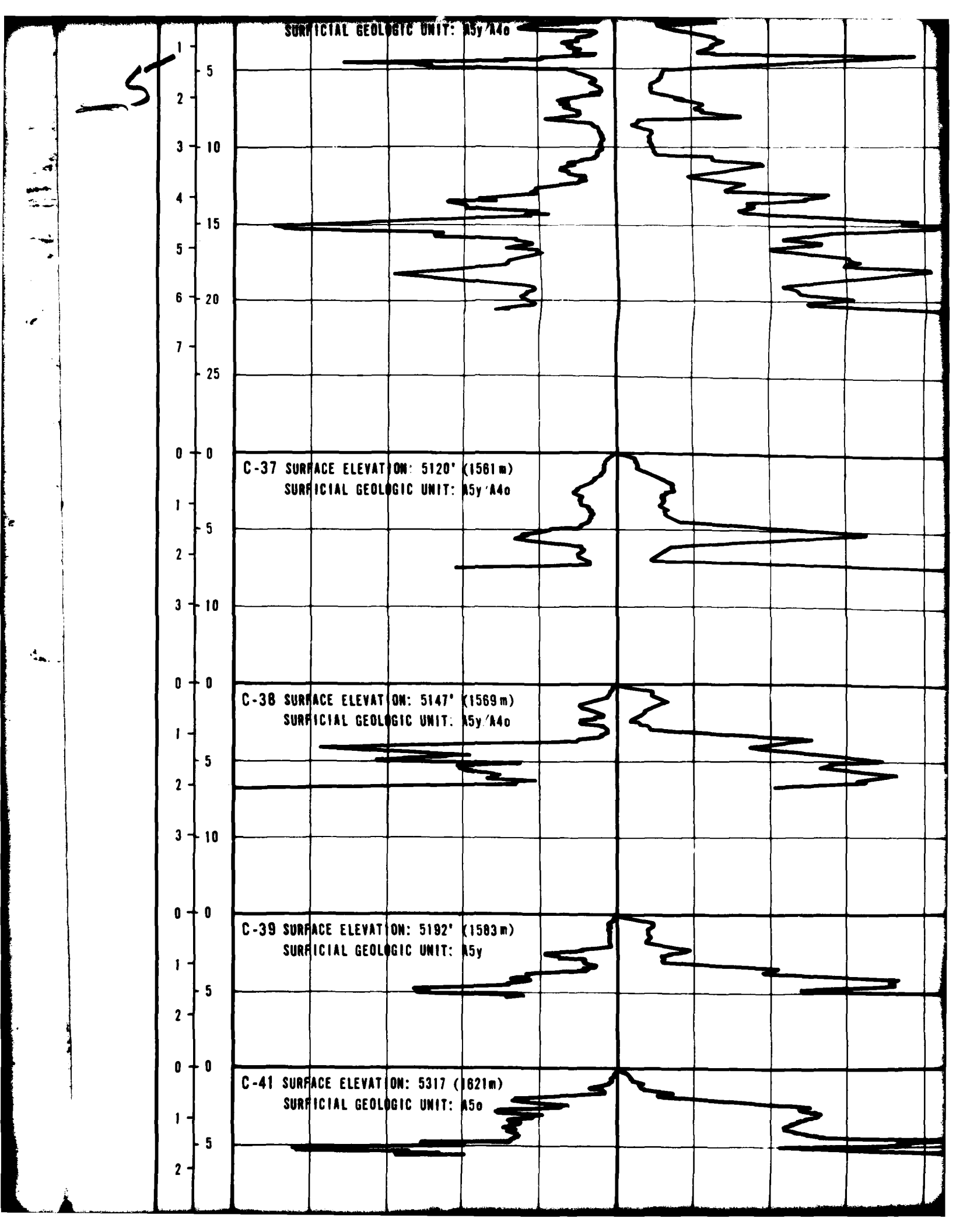
10 8 6 4

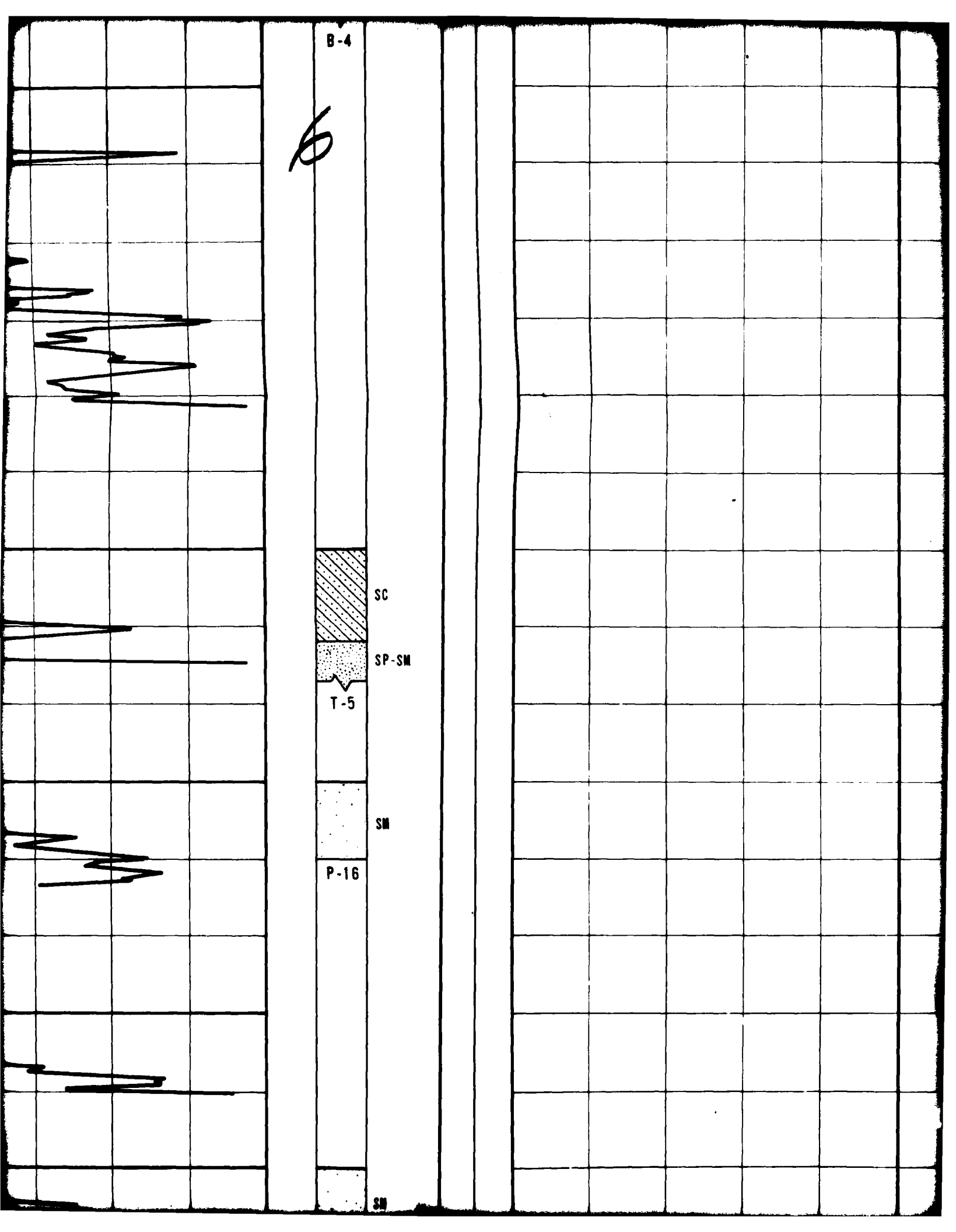
FRICTION RESISTANCE

CONE RESISTANCE

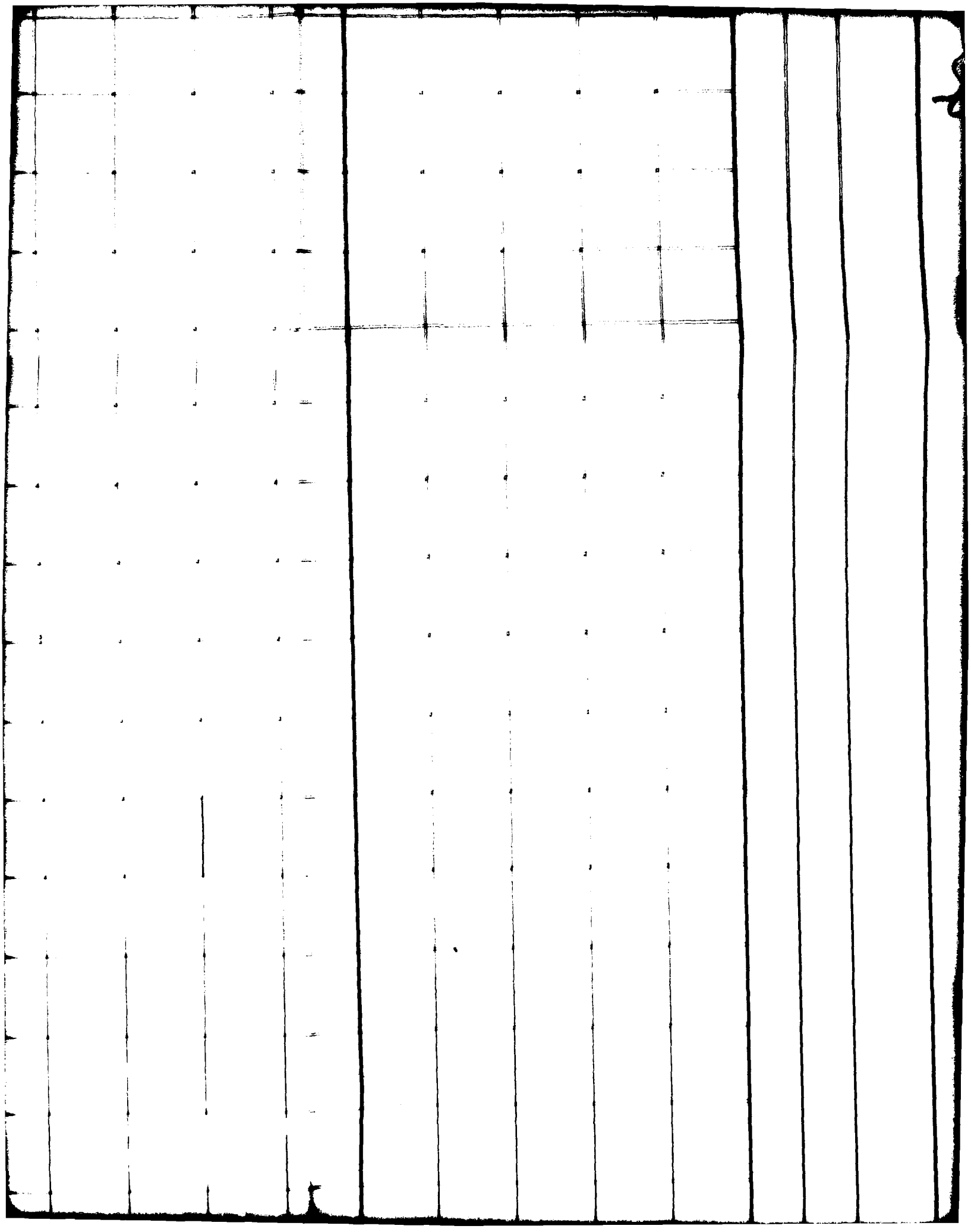
6	4	2	0	100	200	300	400	(kg/cm^2)
6	4	2	0	100	200	300	400	(tsf)

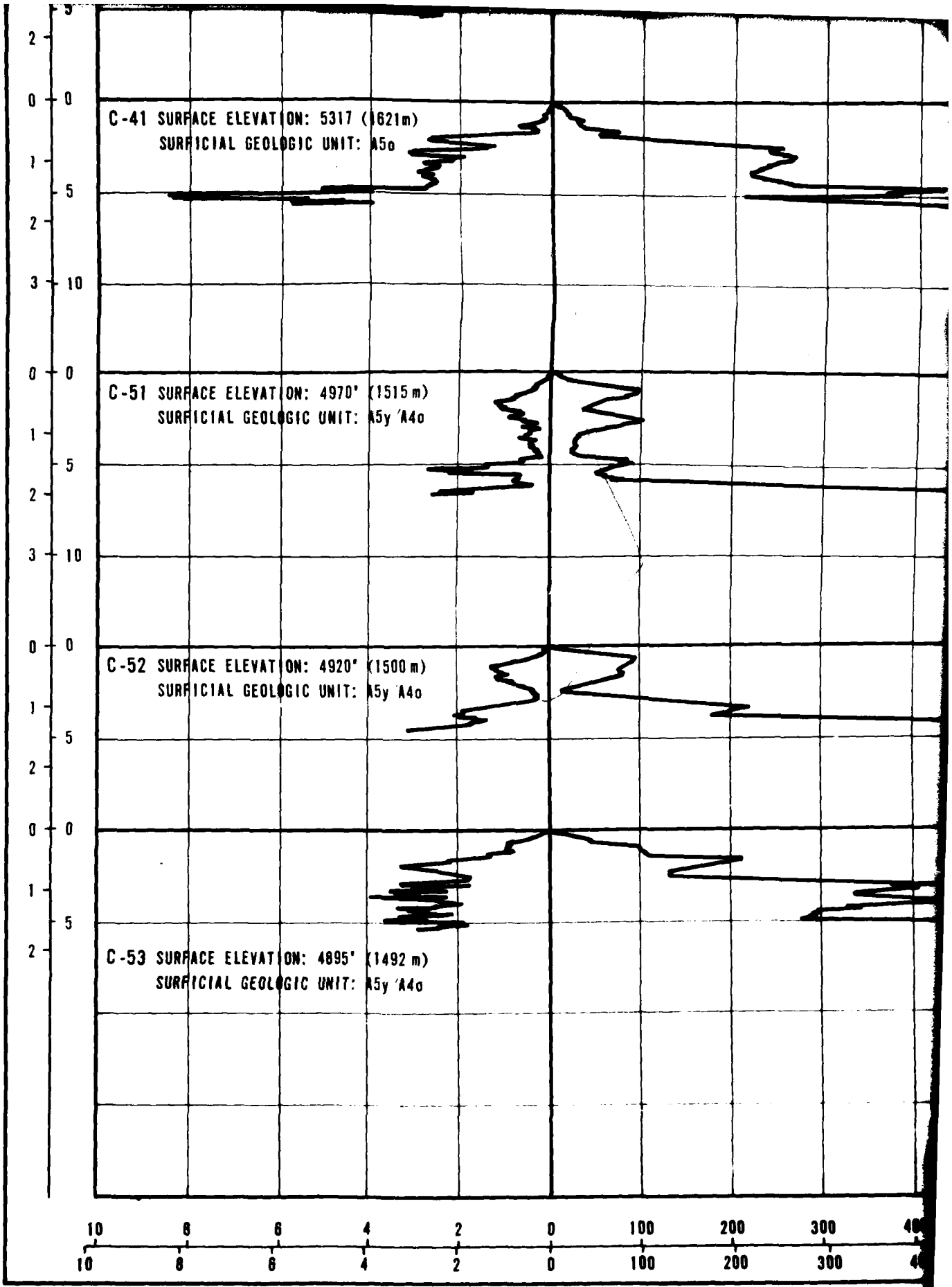
SOIL COLUMN


SURFICIAL GEOLOGIC UNIT: A5y/A4o
C-37 SURFACE ELEVATION: 5120' (1561 m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o
C-38 SURFACE ELEVATION: 5147' (1569 m)
SURFICIAL GEOLOGIC UNIT: A5y/A4o
C-39 SURFACE ELEVATION: 5192' (1583 m)
SURFICIAL GEOLOGIC UNIT: A5y
C-41 SURFACE ELEVATION: 5317 (1621m)
SURFICIAL GEOLOGIC UNIT: A5o


B-4
6
SC
SP-SM
T-5
SM
P-16
SM

7





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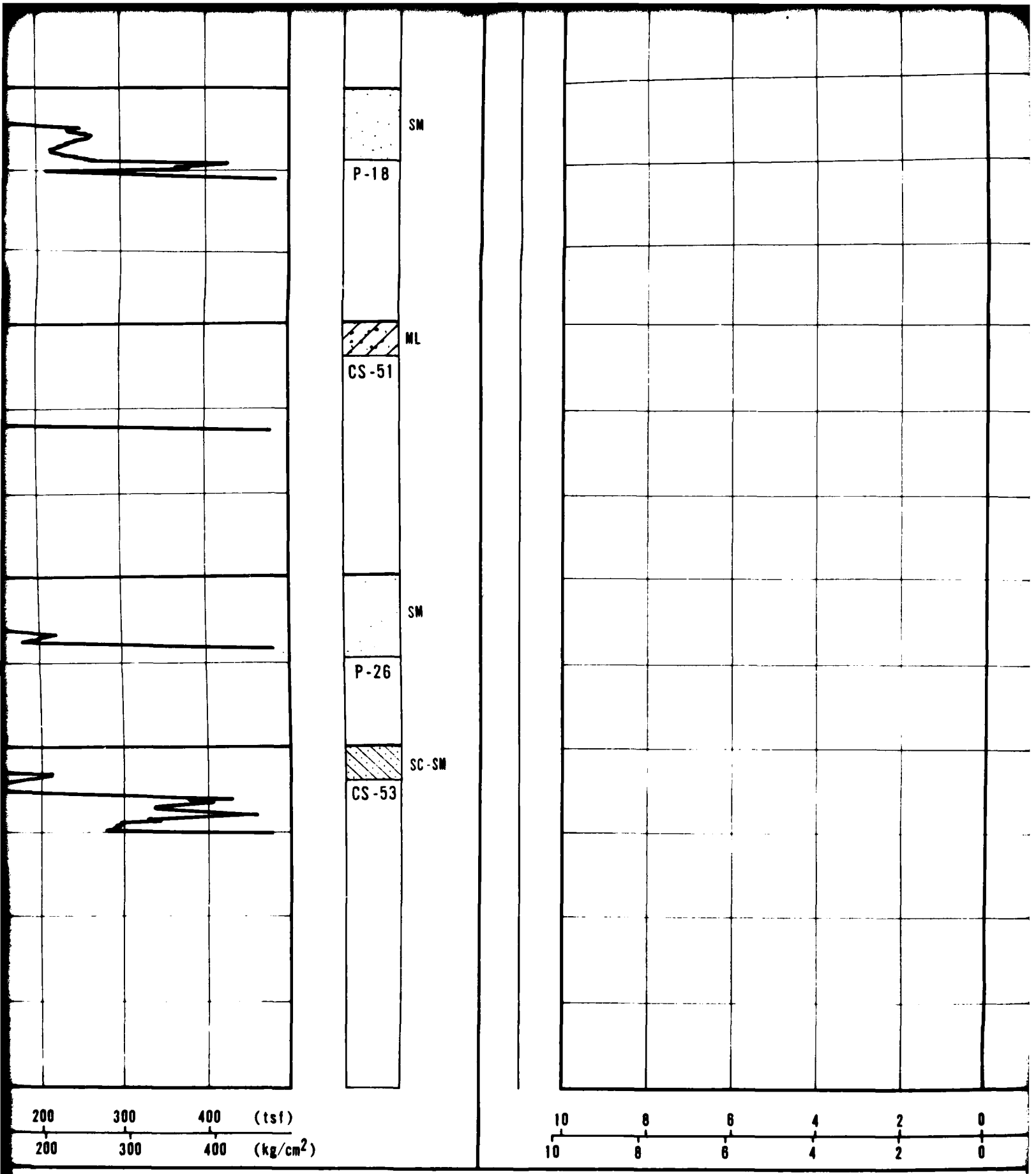
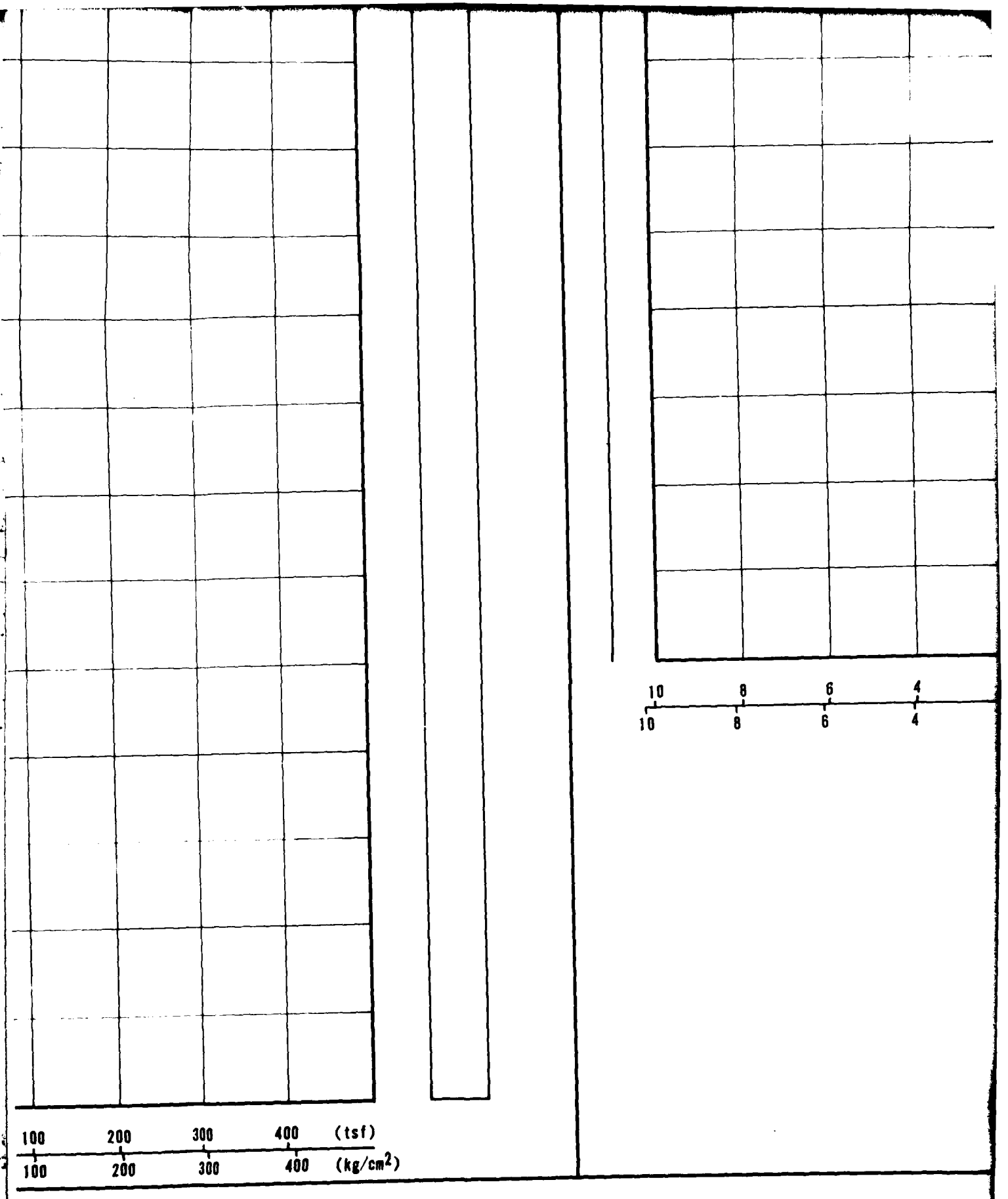
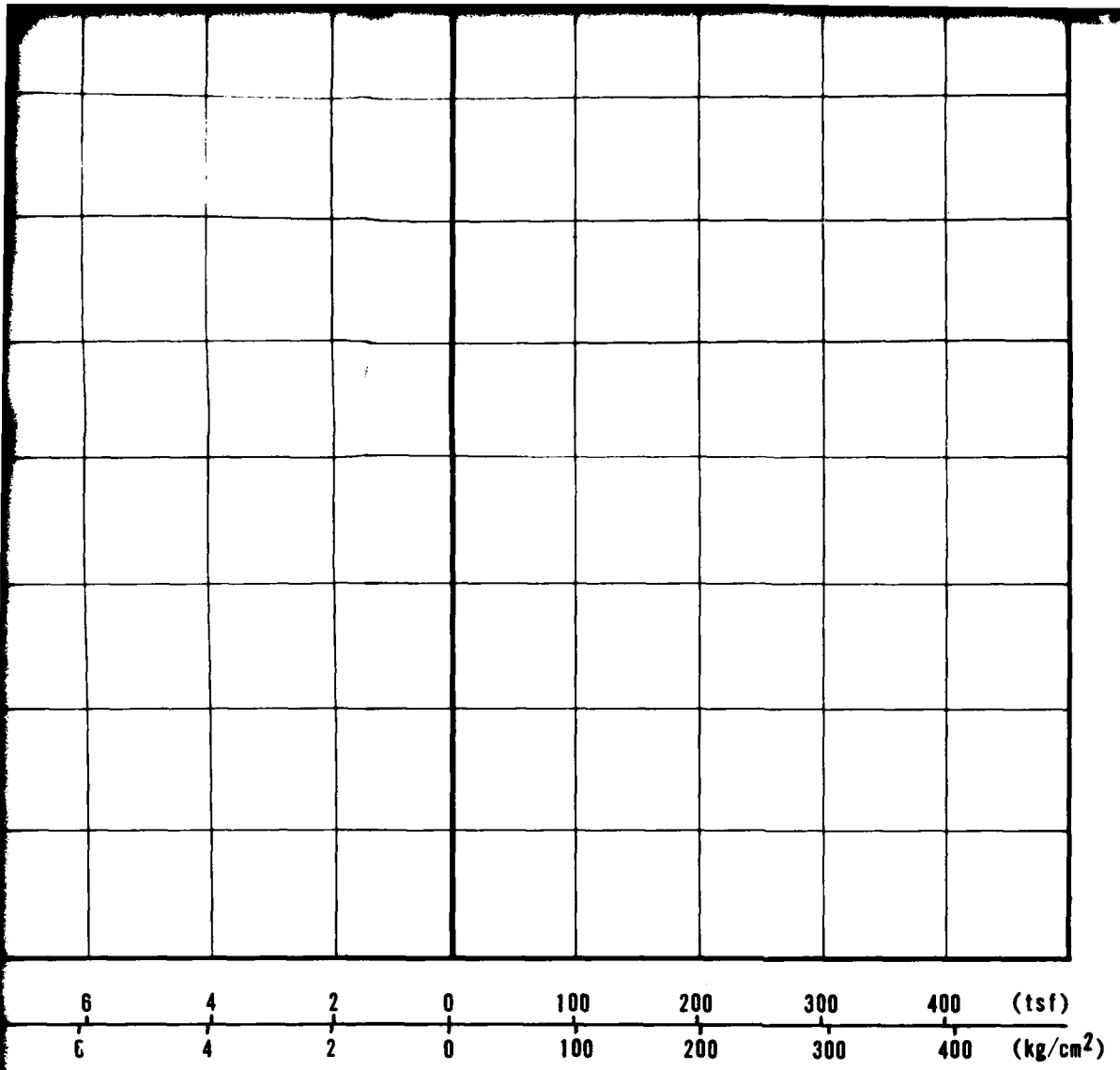

SM
P-18
ML
CS-51
SM
P-26
SC-SM
CS-53
200
300
400
(tsf)
200
300
400
(kg/cm2)
10
8
6
4
2
0
10
8
6
4
2
0


100
200
300
400
(tsf)
100
200
300
400
(kg/cm2)
10
8
6
4
10
8
6
4



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2
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12


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